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Quotations on the Status of Dentistry

This *Journal* uses the term "dentistry" to signify the science and art of oral health service in all its local and systemic relationships. The meanings of words, which are not necessarily restricted to *etymological* significance, acquire expanded or new import in accordance with convenience and usage. Thus the term "medicine," which originally meant to remedy or cure, now also means *to make remedial or curative treatment unnecessary.* "Stomatology" is a synonym for "dentistry." We prefer the older term because its use respects both the history of dentistry and the efforts of those who have brought dentistry to its present status—*Journal of Dental Research*, 1929, ix, p. iii.

Whereas the American College of Dentists is cognizant of the opinion and sentiment, expressed in certain sections of this country, that dental practice could more effectually fulfill its functions by becoming an integral part of medical practice; and

Whereas it is being represented that this opinion is held or endorsed by a considerable portion of the dental profession; therefore, it is hereby

Resolved that the American College of Dentists records its conviction that the above mentioned opinion does not represent the views of more than an extremely small minority of the members of the dental profession; also

Resolved that dentistry, which has evolved during the past ninety years as a natural and distinct division of health service, can best meet the needs of mankind by the further development of its ideals and service through separate and special educational activities, professional practice, and statutory regulation; also

Resolved that the existing personal and professional coöperation and mutual helpfulness between dentists and physicians, and between dentists and practitioners of other kinds of health service, should be continued and strengthened, and that, in harmony with the objects and history of the American College of Dentists, suitable means should be taken by the College at all times to further this accord.—*American College of Dentists, March, 1929.*

Whereas, dentistry, as a separately organized profession, is approaching its one hundredth anniversary; and

Whereas, the profession has achieved remarkable progress in that period, despite numerous handicaps and important opposition; and

Whereas, it is entirely practicable for dentistry to further progress under its own auspices, to the end that it shall become the full health-service equivalent of a specialty of medical practice; and

Whereas, there are current doubts in some quarters outside of the dental profession in relation to the preferences of the profession regarding its own evolution and future; . . . . therefore

Be it resolved, that the American Association of Dental Schools records its opinion that the interests of the public health, and of the medical and dental professions, would best be served by a continuation of the separate organization of the dental profession; and

Be it further resolved, that this Association records its conviction that the recently advocated concept of an ideal dental service, to be practised by a physician-dentist assisted by a group of technicians, is neither practicable nor logical, nor conducive to the best interests of the public; . . . .—*American Association of Dental Schools, March, 1931.*

The stomatologist's concept of dental education and practice finds expression in the activities of a very limited group in this county who, so far as I can see, are making no headway in dissecting a part of the practice of dentistry from its whole and grafting it on medicine; nor do I believe that medicine would welcome such implantation. I have no apprehension over the stomatologist's point of view. In the four countries in Europe, Austria, Czecho-Slovakia, Belgium and Italy, where one must possess a medical degree to practise dentistry, the poorest type of technical dental service is to be found. In Switzerland, Sweden, Norway and parts of Germany, where dentistry is taught in conjunction with medical studies, yet independent of medical supervision, as we teach it in this country, the best type of service is found. Based on my own study of the problem in Europe [1926–27], I would both seek and recommend the services of dentists trained in the latter countries during the past decade and would avoid service in the former, unless I knew the dentist and his work personally.—*Guy S. Millberry, D.D.S., Dean, Dental School, Univ. of Calif.; Pacific Dental Gazette, 1931, xxxix, p. 415; June.*

(Continued on p. 3 of the cover)

COÖPERATION BETWEEN PHYSICIAN AND DENTIST[1]

A Symposium

HARLOW BROOKS, M.D., F.A.C.P., AND ALFRED S. WALKER, D.D.S., F.A.C.D.

New York City

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I. THE VIEWPOINT OF THE PHYSICIAN

Harlow Brooks, M.D., F.A.C.P., New York City

I consider myself very fortunate to have been asked to speak to you this evening, especially on the subject your Committee has assigned to me. The subject is one in which I am very much interested and which suggests much for the future advance of our professions. Irrespective of what you and I may think or wish, I believe it inevitable that in the future dentistry must be considered as a very definite specialty of medicine. There are very many of us who consider that this has already been accomplished in fact, if not in theory. During my war experience my own opinions as to this fact were crystalized definitely. In the army, in the time of stress, dental surgeons often operated on a much wider field than merely the buccal cavity: they gave general anesthetics, did surgical dressings, helped in the treatment of pneumonia and other strictly medical conditions—and, at least in my observation, rarely otherwise than most willingly and successfully. Now, in my regular service, I receive many helpful suggestions from my dental colleagues, involving often a breadth of thought and vision extending far beyond the buccal cavity, or strictly dental problems, if by such you understand matters having to do only with the teeth.

[1] Presented at a meeting of the New York Academy of Dentistry, Yale Club, New York City, January 22, 1931.

The chief obstacle to the immediate consummation of a union of the two professions lies in the overcrowded curriculum for the dental undergraduate student and also for the medical. If we are to have either the young physician or the young dentist, we should not require him to spend more *years* in undergraduate study. If we are to have competent specialists, either in medicine or in dentistry, we must get our undergraduate at his clinical work earlier, not later; nor may we subtract from the preparatory college years, if we are still to be classed as educated and broad professions. Personally I see no reason why either undergraduate dentist or physician may not put in more intensive and consecutive *months* of undergraduate study. The months now given to vacation could be very well utilized for clinical and technical instruction, without harming the young student any more than he will be harmed in his early years of practice, when he is expected to put in, at least during his youth, twelve months yearly, four weeks monthly, and very often seven days and a good many nights weekly in his practice. Intensive medical study may probably not be increased advantageously, but technical work may. The use of instruments, physical diagnosis, and much laboratory work can be well done during the summer months—if we do not consider the sensitivity of faculties; and why should we, when so many young men are anxious for the opportunity of teaching?

There is quite as much necessity for the dentist to know his general biology, pathology, bacteriology and physiology as for the nose and throat specialist, or for the ophthalmologist. On the other hand, as a physician I am quite willing to confess that I know very little, where I should know a good deal, as to the physiology of the upper digestive tract, of mastication, and even of buccal disease. I wonder how many gastro-enterologists are really competent to appreciate the full importance of the first phase of the digestive problem. Not that I would have the physician practise dentistry; far from it. But I would have him appreciate its need; perhaps to know something of its limitations, as I would have the dentist recognize that there are many other sources of infection besides those of the mouth, and many other causes of pain in the mandibles than diseased teeth. I would have, what is rapidly coming about, a better coöperation between dentist and physician, so that the numerous border-line conditions would be treated by them

in a more satisfactory and conclusive manner. For the relief of both the dentist and the physician, I would have resort to technicians to a far greater degree than at present. I should not permit a physician to devote *all* his time to the routine examination of blood and urine, either of which can be done as well if not better by a trained chemist or biologist. I would unload much of the work of the dental laboratory, of the x-ray room and the like, on technicians, as we are rapidly coming to do as a matter of fact. But I hasten to say that I should not permit diagnosis or prescribing by technicians—no more than we do from the pharmacist, whose relationship to medicine and dentistry is precisely like that we would detail to technicians, physicists, chemists, biologists and the like.

But these are evolutionary problems that time will solve. You and I are more interested in those avenues of immediate need in which we may unitedly work to the better advantage of our patient and our public. I have been asked to consider especially the problem of the relation of dental to general infections. Had this subject done no more than to show both the dentist and the physician their mutual need for one another, it would have been well worth the study given to it.

Incredible as it may seem, I have heard it stated by some that dental infections are the most common cause of general disease, and of many special diseases ranging from poliomyelitis and insanity to urethritis and tuberculosis. Nearly all of these fanatics—and some are fanatics to almost a homicidal degree—are, I am very sorry to say, members of the medical profession. A few dentists have also caught the infection, or at least have consented to be the unthinking exponents of this perfectly silly and illogical theory. The cure for all these various diseases, prescribed by these enthusiasts, is: "pull the teeth." And some of you have pulled the teeth. More of you have retorted, I am glad to say, with the question: "Why?" Many of you have wisely refused, unless it could be shown with a reasonable degree of certainty that there was a direct and certain relationship between dental infection and the general infection present in any specific case. For you to obey unthinkingly the direction of the physician in this respect would be about as logical as for you to suggest euthanasia to the physician for the treatment of dental caries, or amputation of the penis for male gonorrhoea.

Let us come down to reason in the study of this matter. There is no question whatever that certain general infections do originate from dental infections. In all probability occasional cases of endocarditis do so originate. Cases of arthritis are undoubtedly due to such a source. But only the acephalic can assume that all cases of arthritis so arise, or that all endocarditis is of such origin. Physicians addicted to this one-celled reasoning forget the fact that we also know that very many general infections originate from various other occult foci, notably from the gall bladder; breaks in the continuity of the mucosa of the mouth, esophagus, stomach, small intestine, colon, sigmoid, and anus; the vast area of the skin; the urethra, prostate, or uterus; the vast extent of the respiratory tract, especially from the nasal mucosa and its wide and complicated extensions in the sinuses; etc. I admit that, dental infection having been shown to exist, it may be a possible cause of certain general infections by the streptococcus group, provided that specific infections such as scarlet fever, tonsilitis, and the like, known to originate most commonly from throat inoculations are eliminated, and also when the other frequent avenues of focal entrance have been equally considered and eliminated. When, however, no dental infection can be detected by the dentist—not by the unspecialized and unqualified physician—I deny the right of the physician to demand from the dentist the sacrifice of a tooth or teeth believed by the dentist to be sound. X-ray diagnosis in dental infections, we must recall, is no more accurate than in any other field when unconfirmed by clinical findings.

The relief of an arthritis, or of a tuberculosis, or the repair of a poliomyelitic paralysis, after an extraction, does not prove its dependence on that dental infection any more than does the relief of an arthritis, or of a hysteria, or of a neurosis, under osteopathy or Christian Science, prove their therapeutic value. The influence of the human mind on all disease processes, notably on some and in certain types of individuals, is too well known to permit us to reason from effect to cause in so loose a manner. The claims of all kinds of quackery are as well proven and as logical in many instances as the cure of general disease from the extraction of an apparently unhealthy tooth. Neither are we justified in concluding, when an organism, sometimes pathological in its action, is discovered in cultures from

the questionable tooth, that this organism is really doing harm, unless we can also show that the diseased general focus has a similar organism. Even then, we must recall that many dental infections are secondary to general infection, and not primarily causative, just as are the petechiae in subacute endocarditis, and so on. It is a well recognized fact in pathology that in most instances the elimination of the primary infected focus relieves, and may even remove or cure, the secondary process it originates. This is not however infallible, as in many cases of anthrax, syphilis, glanders, etc. What then must be our procedure? I am in complete agreement with the idea that where an infectious process is present, and the apparent point of entrance unknown, a dental examination and report are called for, not merely an x-ray report, nor the opinion of a physician familiar only with x-ray findings, but the judgment of a dentist competent to make such a diagnosis. I know few physicians who are, but there may be some. Now it so happens that the lymph nodes nearest the point of primary infection are usually first to be enlarged in any infectious process that extends through the lymphatics, as most streptococcal infections do. The presence or absence of such enlarged lymph nodes should then be of the same value to you, in your diagnosis of the probable relation of a general infection to a possible dental source, as is an enlarged inguinal node to the gynecologist in the diagnosis of a salpingitis or vaginitis. I do not need to tell you as dentists of the signs that the tooth and gum manifest in most instances of true dental infection. The x-ray findings are of tremendous assistance beyond doubt, especially in a positive direction, but not necessarily in a negative way. We in clinical medicine rarely accept as final an x-ray diagnosis; we accept it only when confirmed by other clinical indications. Capable and learned dentists have told me that they feel the same way toward the x-ray diagnosis of dental infections.

Thus far I have said in brief that, before we are justified from the physician's standpoint of suspecting a dental infection as responsible for general infection, we must eliminate other and nearer probable sources of infection so far as history and careful physical examination indicate. If symptoms or signs, however, pointed to a probable dental source, I should cut short my search and look for the enlarged adjacent lymph nodes for example. I should then refer my patient,

with a brief history of the case and with a citation of my suspicions, to a competent dentist. I should expect him to make a careful and unbiased examination, including the use of the x-ray, and would compare his opinion as to its indications with those of the x-ray man and his dental consultant. I should then consider that I had done my best for the patient, except that I should ask of the dentist his opinion as a dentist on what should follow in the way of treatment. As a physician I have no authority or justification to prescribe the character or time of dental treatment. That must come from the dentist. I believe, however, that my patient has the right to demand of me that I acquaint the dentist fully with the medical aspects of the case. If the patient is anemic, malnourished, the subject of blood dyscrasiae, such as hemophilia or purpura, as is often the case, the dentist has a right to know it; and the patient's rights are grossly transgressed if I do not so inform him. If the state of the patient, or independent or concurrent diseases, are such as to make a dental impairment a grave matter in his prognosis, that also I should tell the dentist. He then, being in possession of all the known essentials of the case, must decide what shall be done in a dental way.

Radical, indiscreet, untimely, and, worst of all, unnecessary extractions are far less likely to take place when the dentist is left to his own discretion as to the treatment in such instances. In a good number of instances, I have seen death follow extractions in leukemia, in pernicious anemia, in hemophilia, and even in grave secondary anemias. I have seen cases of pulmonary or generalized tuberculosis, or pernicious anemia, malignance, and the like, date their decadence from untimely, unwise, or wholesale dental extractions. I feel that there are many instances of general disease, even when complicated by dental infections, in which radical dentistry is most unwise. How could it be otherwise when, for many years, I have been responsible for a service in the City Hospital and in Bellevue Hospital, where a high percentage of the patients admitted suffer from dental infections of one sort or another. I have always been one of those most anxious to welcome the attending and consulting dentists to my wards.

In brief, I believe that, in the matter of dental infections in their relationship to general disease, full coöperation of the physician and dentist is most strikingly indicated. I believe however that the

physician must be most careful not to err in suggesting, to the qualified dentist, a diagnosis and possibly a treatment he is not competent to suggest, unless the physician also has enjoyed a dental training and experience. It is very unfortunate that clinical science, and therapeutics particularly, advance by exaggerations. It is so easy to "pass the buck" and, because a subject is popular and the patient submits more willingly to the new and popular, to jump to illogical conclusions. Happily both professions are coming to a more sane and correct understanding of the relation of dental infection to general disease, and of the rôle that we should mutually play in its diagnosis and management. Many other subjects require our united study and judgment. The more frequently we come together in such problems and contacts, the better for both professions, and for our patients.

To revert now to the main question: coöperation between physician and dentist. There are very few branches of medicine in which dental problems may not arise, and in which discreet dental judgment is not of value. Signal illustrations of our mutual dependence and of the greater benefit we may give to our clientele, by the mutual consideration of clinical problems, are seen notably in reconstructive surgery, particularly of the head, orthopedics, pediatrics, gastroenterology, and metabolic disorders of all sorts. Even in a field apparently so foreign to dental interests as obstetrics, dental problems appear: the rapid deterioration of the teeth of the pregnant woman during the months of gestation, the dietetic and metabolic problems having to do with the proper development of the teeth of the fetus, and so on. Yet I cannot conceive of any dentist becoming so interested in the problems of obstetrics that he should wish to visit *as a routine* the sessions of the New York Obstetrical Society any more than I should be interested in them as an internist, although obviously many phases of the obstetric field are of keen interest and importance to me, cardio-vascular disease in particular. Similarly in most of the other branches of medicine, we can hardly hope, even if it be desirable, that all dentists and all physicians should mutually attend the same meetings. In my opinion the best interests of both professions are not in the line of mutual meeting-attendance. Rather it is only the unusual general meeting or convention that is valuable equally to both types of practitioners. It is chiefly when the discussion of

border-line problems is under argument that this mutual meeting is profitable. There is, however, one large field in which both groups should be mutually interested and actively concerned. It is in the wide district of the basic sciences, in which scientific medicine and dentistry are mutually founded. Both professions are dependent upon and concerned in the problems of pathology, biochemistry, biology, and especially in physiology. I know that the advance of these sciences would be greatly accelerated, if dentists attended and participated in meetings in these fields as freely and generally as physicians do. The ambitious dentist should be as keenly interested in such societies as physicians are. How many of you are members of the Society for Experimental Biology and Medicine? Yet I am certain that you would find the meetings of this society, cited for example only, as profitable as I find them to be.

The unity of our professions, which I have already prophesied as rapidly taking place, could be more speedily accomplished and consummated by efforts in this general direction. I believe that the technical methods of our work, which must always be very widely at variance —precisely as is the case with surgery, nose, throat and ear departments, neurology, gynecology, opthalmology—should be acquired in hospital service after graduation from the professional schools, and during the summer vacations, which, from the standpoint of the undergraduate student, is time now largely wasted. It is economically impossible and undesirable for either profession to increase the duration of the undergraduate work. In that event we should lose for our younger members the possibility of economic independence, and for our professions the necessary verve and stimulation that are chiefly derived from our young and more aggressive members. If our work is to continue to advance we may not depend solely on the efforts of those altruistic men who derive their income from other than their own efforts. Little has been accomplished in either medicine or dentistry from the labor of the amateur or dilettante. Two sources of origin have given us what we have in medical and dental science, the researches of pure science and those of the agressive, ambitious, and not too old clinical practitioner. Let us then unify our work and our professions by a common study of the problems of basic pure science, and also, by a sharp division as in the past in technical training and

practice, with mutual study and frequent discussion of the many border-line conditions with which both professions are concerned, not as members of different professions but as specialized yet mutually dependent members of one.

II. THE VIEWPOINT OF THE DENTIST

Alfred S. Walker, D.D.S., F.A.C.D., New York City

At the outset I shall take it for granted that there is general agreement on the part of both physicians and dentists to the effect that disease in the mouth, especially infection, plays an important part in the causation and progress of many systemic diseases. We may also agree that the influence of the general health on the condition of the teeth and their surrounding structures is potent. Dentistry approaches this dual problem with the realization that the dental profession has something to contribute to the general health of the community, and also that it is dependent to a considerable extent for the success of its labors in its own field upon factors that originate in general health. Dental service, considered by itself, presents a major problem from the standpoint of human need and also from the standpoint of economics. When I say economics, I refer not alone to the problems the individual dentist must solve in his efforts to earn a reasonable income, but also to the problem of the economics of dentistry from the standpoint of the community. I emphasize community here, rather than the individual patient, for the reason that I wish to call attention among other things to the needs of the community from both medical and dental standpoints.

I may, perhaps, most effectively bring out the point I wish to make by calling attention to the methods by which general disease in a community is controlled. Not only are individual patients served by individual physicians, and by hospital service made available when needed under what is essentially group medical practice, but in the preventive field health-measures are also applied on a very broad scale. We have, for instance, control of water supply, disposal of sewage, etc., housing regulations and other measures applied en masse rather than to the individual. Also, in the case of diseases like smallpox, diphtheria, etc., a high percentage of prevention is attained by

a simple inoculation of the individual. Dentistry does not offer anything comparable to this, nor have we any formula which, even if it could be put into effect, would be likely to control dental disease in a comparable manner. Even when we compare the service of the individual dentist and individual physician to their patients, we see a wide discrepancy on the basis of the time required by each to serve the patient. The physician is consulted by his patient, and after studying the case he makes a diagnosis and prescribes treatment. Here his personal service stops for the time being, and the patient applies the treatment or is cared for by a nurse. Even in the latter case the processes of repair are going on in the patient's own system without direct outside intervention. On the other hand, when a patient consults a dentist, the dentist must, after making his examination and diagnosis, carry on the entire treatment which he has prescribed. It will be readily seen that the number of patients who can have their mouths put in order by one dentist is much smaller than the number who can be given complete health treatment by one physician. In this connection it may be of interest to cite some figures obtained as a result of examinations of members of the Boys Club of New York by senior students from the New York University School of Dentistry: "*Report dated December 30, 1930*—178 boys between the ages of 12 and 17 were examined in five examination periods. In this group of *boys*—98 had abnormal occlusion. Of the *first permanent molars*, 121 were missing; 310 had cavities to be filled, and 70 were in such an advanced state of carious disintegration that extraction was indicated. Of the *second permanent molars*, 7 were missing, some of which had probably been extracted; 301 had cavities to be filled, and 9 were in such an advanced state of carious disintegration that extraction was indicated. There were 46 *miscellaneous teeth* missing; 329 had cavities to be filled and 57 were in such a condition as to indicate the necessity of extraction." We have here, in an unselected group of a total of 178 boys, 940 cavities to be filled, 136 permanent teeth to be extracted, and 174 permanent teeth missing, most of which no doubt had been removed.

In estimating the time required to serve these boys, we find that a minimum of 554 chair-hours are required for prophylaxis and cavity filling alone. In addition to this, 98 boys are already afflicted with

abnormal occlusion; and, in view of the recently removed permanent teeth and those to be extracted, there is a considerable additional number of occlusal abnormalities. It would be difficult to estimate even approximately the time required for the orthodontia and replacement that would take these boys out of the crippled class. For the orthodontia, on a basis of 20 hours per year per boy for a two-and-one-half-year period, a total of 4900 hours is a conservative estimate. This includes laboratory time. To this must be added the time required for replacement, which is difficult to estimate but which would easily account for another 1500 hours. This brings the total up to 6900 hours, to the cost of which must be added the expense of material. This, you will agree, presents a staggering problem not alone as applied to those whom the report covers, but to the hundreds of thousands throughout the land who are in the same predicament. Lest it be thought that we have been considering an unusual group; or that unusual dental conditions are to be found in the city, consider a report of the Locust Valley, Long Island, School. This report carries information obtained at the examinations of 580 children, December 8 to 19, 1930. Of the total number, 451 (77.7 percent) were in what the examiner terms "Class 1"—cases in which there are teeth with dead pulps, abscessed teeth, teeth with caries penetrating to the pulp, or well advanced toward that condition; 99 (17 percent) had teeth—Class 2—affected with "superficial" caries; in 258 (44.48 percent) the teeth—Class 3—required orthodontic treatment; in 31 (5.3 percent) the teeth—Class 4—were considered in good condition. A single mouth, according to this classification, might present both the Class 1 and Class 3, or Class 2 and Class 3 conditions; that is, it might have either deep or superficial caries and also require orthodontic treatment.

It will be agreed by experienced dentists that these figures represent the average dental needs of city and country children of these ages and economic levels. They indicate graphically the tremendous chair-hour requirement in community dental-service. If we were to make a serious effort to bring dental service in the community up to the level of medical service, as regards the number of patients served, it would be necessary to have more dentists than physicians instead of more physicians than dentists, as is now the case. Even the application of a comprehensive program, beginning treatment on

the very young child and thus minimizing dental disease to the utmost, would not appreciably alter the needed ratio of dentists to physicians.

When we consider the relationship of medicine and dentistry in the prevention of disease, we must view it from two aspects. Perhaps the most interesting one is that which is concerned with the protection of general health by means of maintaining health in the mouth or by the correction of disease therein. In this phase of the problem we see perhaps the most important need for the coöperation of physicians and dentists. There comes first to mind the "focal infection" problem. We are agreed that infection in the mouth may seriously involve the health of the patient, but when we apply this principle we find many points on which agreement is not so readily reached. The physician may be uncertain as to whether a given disease condition is actually being caused by focal infection. Unless he expresses a clean-cut conviction that such is the case, the dentist may have difficulty in deciding what procedure he shall carry out in the mouth. But, even when the diagnosis of focal infection is definitely made, the dentist may have very honest doubts as to whether infection is present in certain localities in the mouth. Another complication on this side, which must be reckoned as a definite possibility, is the apparent occurrence of dental infection in some cases as a secondary focus, bacteria having been brought to the oral tissues from another part of the body. I do not state these things as being new, but merely to bring out the necessity for both careful and sympathetic coöperation and consultation between the dentist and physician, in the management of individual cases. Perhaps the greatest difficulty that complicates such coöperation is the existing difference in the points of view of the physician and the dentist. One reason for this is undoubtedly the different methods that must be followed, as has already been pointed out, in the service to the patient by the dentist and the physician. Another explanation is the different methods followed in the training of dentists and physicians. That improvement in dental education along this line is needed is generally agreed, and it is only necessary to state that dental educators are making every effort to correct the present differences.

The other phase of dental service in which the coöperation of physicians and dentists is needed is the prevention of dental disease through

measures relating to general health. The beginning of this service is in pre-natal care. Undoubtedly the foundation for dental health must be laid during pregnancy. The mother's health must have every consideration, and may well include the elimination of infection from her mouth. She must also be advised as to her diet, so that the calcified structures of the fetus will be properly developed. Here the dentist and physician meet on common ground. Naturally the physician must take the lead, but in doing so he must assume the responsibility for the dental conditions of the child. Patients commonly and rightly consult their dentist as to what they should do at this time, and they sometimes ask his opinion on matters about which they should be advised by the physician. Consultation between the two is suggested when such questions arise. In the early post-natal period also the physician naturally has full charge of the child. Here again he must assume his responsibility for the developing teeth by prescribing diets that supply the necessary elements. Having given the child the right start in life, from this as well as other standpoints, he will then turn over to the dentist a patient for whom the dentist can gain the maximum results with his necessary dental service. The dentist on his side, as he comes into contact with the young patient, can render a frequently needed service by suggesting to the parents the importance of periodic physical examinations by the physician. Team work developed along these lines will inevitably produce maximum results both in dental and in general health.

Another aspect of our problem is that relating to community health. While dental conditions as factors in general health have been receiving considerable attention, the real importance and urgency of this situation have not been sufficiently appreciated. Any comprehensive health program, preventive or curative, must recognize that dental service presents a major problem from the standpoint of human need, and also from the economic viewpoint. The seriousness of the latter problem has already been indicated, but the prevalance of dental disease as a factor in lowered vitality in the community has as yet hardly been appreciated. To raise the standard of community health is going to tax the combined ability and technical resources of both the medical and dental professions. Dr. Michael Davis has brought

forcibly to our attention the overwhelming need for dental service, but there remain many in our profession who do not distinguish between "need" and "demand." To them the demand for service is an individual problem, that is, the seeking of the dentist by the individual patient. What dentistry must now do is to think of its obligation to the community as the physician does.

Dentists must organize somewhat along the lines heretofore followed by the medical profession in its attack on community health problems. It may be of interest to state in this connection that a Committee has already been appointed by the Dental Society of the State of New York following the recommendation adopted at the recent White House Conference on Child Health and Protection. At the final meeting of the 1930 Session, on November 22, the Conference adopted a 19-point program.[2] The points that directly applied to the dental profession were these: Every child should have regular dental examination and care. Where the child does not have the services, due to inadequate income of the family, then such services must be provided to him by the community. From the recommendations of the Committee on Medical and Dental Practice, the following is quoted: "There are certain phases of Public Health work which are especially adapted for developing an attractive program of coöperation between health agencies and the physicians and dentists of the community. The state and local health departments should advise with the medical and dental professions in determining such programs. The state medical and dental associations should appoint for the benefit of the state health officer advisory committees approved by their legislative bodies. Likewise the district or county organization should appoint advisory committees for local health officers." I am glad to say that the Dental Society of the State of New York is definitely on record as being prepared to meet these recommendations. The Committee appointed for this purpose has established contact with those sections of the White House Conference that are concerned with the problems alluded to.

We are constantly hearing of the possibility of preventing or even alleviating dental disease through the medium of diet. While much

[2] Hellman: *Journal of Dental Research*, 1931, xi, p. 244.

can undoubtedly be accomplished in this way, it is important for the dentist to remember that he should not prescribe specific diets except with the coöperation and consent of the physician. Certain disease conditions of the general system require modification of the dietary, and such modifications must in many instances be followed regardless of the apparent dental requirements. In such cases the dentist may do much harm by insisting on a dietary which, for the healthy patient, might be entirely satisfactory. This situation provides an obvious opportunity for coöperation between the two professions in disease prevention.

The dentist may inquire as to whether or not the patient has recently had a physical examination. This is another opportunity for coöperation that is frequently missed. It is surprising how frequently periodic examination of children is neglected simply because the necessity for it has not occurred to the parents. It is the duty of the dentist to ask questions concerning this matter, and to suggest the importance and necessity for this service in the interests of the child. In fact the name of the patient's physician should be a part of the record on every dental case-sheet and chart. I cannot escape the conviction that it would be appropriate and helpful to include the name of the patient's dentist as part of the medical record. Since in modern dental practice x-ray records are made at least annually, such records should be made immediately available to the physician. It occurred to us some years ago that we might assist the patient materially and help the physician by suggesting to them that, if at any time the physician desired a report on the dental condition, we had a complete record of the dental condition as well as the x-rays on file and the physician might have them at any time. This brought very good results. We were able to save the patients a great deal. We were able to forestall overzealousness on the part of some of the surgically inclined. More recently it occurred to us that it would be a good idea, especially with the new patient, to get the name of the physician, place it on the record file, and send a note to the physician, something like this: "Dear Dr. ———: Mrs. ——— has placed herself in my hands for dental service. She has informed me that you are her physician. I have on file a complete dental record, including x-rays. You may, upon request at any time, have from me a report concerning the condition of her teeth and mouth."

It is frequently observed that growing children pass a physical examination with high rating in every respect except for teeth. Boys and girls of normal weight, normal bony development, and apparently in the best of health may present deplorable dental conditions. An interesting question that is now receiving attention is the possible relationship of rickets and dental caries. This relationship is predicated on the fact that rickets affects chiefly the calcification of the bones, and might therefore be assumed to affect also the calcification of the teeth. We are informed, for example, that in Mulberry Center 80 percent of the Italian children show evidence of various degrees of rickets, while the Jewish children in the same locality are free from this malady. I refer again to some statistical data gathered at the Tompkins Square Branch of the Boys Club of New York. In 3008 boys, the nationalities being German, Russian, Irish, Italian, Jewish, and Slovak, there were 14,080 cavities. The instances of caries varied very little in the different nationalities, the highest being in the Irish and the lowest in the Italian. These figures indicate that the Italian and Jewish children suffer almost equally from caries, there being an average of 0.55 percent more per boy among the Jews, thus indicating that rickets is not the only influence affecting dental conditions.

That there is a need for coöperation between physicians and dentists in the prevention of dental disease is self-evident. The statistical evidence quoted in this paper does not differ materially from that which any community in the land may provide. Dentistry must assume its responsibilities and carry on its part in community health activities. Unless it does, our profession can hardly expect that coöperation from the medical profession, in the prevention of disease, of which we recognize the need. The thought of coöperation indicates that the responsibility is not wholly ours, but organizations already giving active attention to these problems rightly look to us for leadership and constructive effort in attacking the dental phases of the problem. The resources and facilities of these organizations are available to our profession, if we indicate our willingness to do our share of the work.

With regard to the prevention of dental disease, we must admit that we can do little for those already afflicted. What may be accomplished for future generations is truly a public-health problem, in which dentists and physicians must work side by side. The dental pro-

fession is to a large degree conscious of present conditions, and is rapidly awakening to a full realization of the broader aspects and consequences. I expect to see an increasing tendency on the part of dentists to affiliate themselves with physicians in movements intended to prevent both dental and systemic diseases. Only in that way can dentistry gain recognition as an important agency for human welfare.

III. DISCUSSION

William Rice, D.M.D. (Boston, Mass.): I have listened to the papers with very great pleasure, and with resulting profit to myself and to those with whom I am working in a common effort to advance the cause of dental education. Dr. Brooks has given us an illuminating illustration of the fact that dentistry is recognized by medicine as a correlative branch of health service. We have been seeking this recognition for many years. I have maintained that we would receive it as soon as we deserved it. Both professions are concerned with the prevention of disease, with the maintenance of health, and with the diagnosis and treatment of disease. The problems of the dentist are certainly of the same nature as those that concern the specialist in medicine. Dentistry no longer confines itself to filling cavities in teeth, or restoring by artificial means teeth that have been lost through disease. The dental student today is given an excellent opportunity to observe all lesions within the oral cavity, and to study these conditions. I believe that the graduate of today who has worked intensively is as well qualified to detect the early indications of disease as is the average physician—perhaps even more so. It is very significant of the recognition of dentistry that in the Medical School of Yale University they are just now establishing fellowships for research in dentistry.

As an administrator in a dental school, I am able to say that the applications from hospitals for men to take dental interneships is increasing very rapidly. Just before leaving Boston I received a letter from a young dental graduate at Johns Hopkins Hospital. I am going to read a few significant lines: "The longer I stay here, the more I am aware of the value of such service in a hospital. The first point, I think, that one becomes aware of is the vast field there is for dentistry as an adjunct to the practice of medicine." This young man appreciates his opportunity to enlarge his sphere of usefulness by helping to make a diagnosis of conditions involving not only the teeth but also the entire body. This is the spirit of the modern dentist. President Lowell once said that he believed in "intellectual burglary;" he cares not where a man obtains his knowledge, if he

is able to apply it to human needs. I think it makes little difference whether the young man or young woman receives training in a medical school, or in a dental school from a medical man who is professor of physiology, or from a physiologist, from a pathologist, or from a medical practitioner who is also a pathologist, or from a dentist who knows pathology. It matters little through what channels this education comes, but it matters much whether he possesses this knowledge and is able to apply it.

Morris I. Schamberg, M.D., D.D.S. (*New York City*): It was my pleasure some years ago to participate with Dr. Brooks in presenting papers at a meeting in the southern part of the city on a subject similar to the one we are discussing this evening. At that time Dr. Brooks showed his good medical judgment in giving to the dental profession its just deserts for participation in the preservation of the health of the community. There is no field that deserves our consideration so earnestly as the need for coöperation between the physician and the dentist. This is evidenced by the correlation of dental disease with systemic disease. The contact that is sometimes occasioned by consultation between physician and dentist is not always made with intelligent coöperation.

Last evening Dr. Cameron of Philadelphia read a paper before the Oral Surgical Section of the First District Dental Society on osteomyelitis. Dr. A. A. Berg, a prominent surgeon of New York, and Dr. H. S. Dunning discussed the paper. All were agreed that much harm is done by the injudicious advice, more particularly of physicians and occasionally by incompetent dentists, to apply heat to the face during acute inflammatory swellings or acute infections about the face. This treatment has emanated, apparently, from the medical practice of endeavoring, by poulticing infections, to bring them to the surface or to await their development until their true nature can be recognized. This practice, however, is distinctly harmful; it is productive of great destruction, and often endangers the life of the subject. It was generally agreed last evening that this temporizing method is probably responsible for most cases of osteomyelitis and for the spreading of other varieties of infections, including Ludwig's angina, and possibly of various forms of necrosis and ensuing destruction of the jaw bones. It is true that heat often alleviates pain more readily than cold applications, but it is distinctly well established by those who are practising surgery of the face and jaws that heat so applied is highly dangerous and productive of great harm to the patient.

I have been impressed by the talks of Dr. Brooks and Dr. Walker. It is practically conceded that the dental practitioner today is better medi-

cally educated than the medical man is dentally educated. I do not refer to men like Dr. Brooks, whose postgraduate efforts have been such as to keep him well acquainted with what is going on in dentistry, but rather to the mass of practitioners. Having been a graduate in both dentistry and medicine, my observation has taught me that, in the undergradute curricula, much more instruction is given in medicine to the dentist than in dentistry to the medical practitioner. Therefore, I believe a very important step by this Academy would be to encourage the inclusion in every medical curriculum of a course of lectures bearing upon this subject. They need not be intensive, nor detailed, but could present the matters that are essential to proper coöperation between medical practitioner and dentist. The dentist seldom usurps the functions or powers of the physician, seldom invades his territory to treat medical conditions; his efforts have been mainly those of coöperation with the physician. But I do think that very often the physician arbitrarily outlines certain forms of treatment in dental cases that are not only unwise but distinctly harmful to the subject. I think much good could be accomplished if well qualified dentists, giving dental instruction in medical schools were also asked to give lectures or papers before *medical* societies, so that practitioners who have not had the benefit of this instruction could receive the high points that are so essential for an understanding of dental disease and its bearing upon medicine.

When a patient of mine went to an esteemed physician for advice in regard to her sinuses, the physician asked: "Have you any abscesses at the ends of your teeth or any focal infection about your teeth?" She said: "Well, I had an abscess upon a lower incisor tooth. A man well up in the profession had done an apicoectomy upon this tooth." He said: "What fool advised that?" This man's attitude was similar to that of some of the members of our profession who believe that no pulpless tooth should remain in the mouth, and he was arbitrarily making an abusive statement about an operation known to have been well accepted and applied. Recently a patient came here to show me x-rays of a tooth retained for twenty-three years, although we promised her little more than four or five years' service from it following this same operation. Unwise comments by persons unqualified to pass competent opinions should be discouraged. The physician I have just quoted didn't know who had operated upon the patient, but he illustrated the type of ignorance, of what is well accepted in our profession, that prompts medical practitioners occasionally to give patients harmful advice.

Russell Cecil, M.D. (*New York City*): I think the special meetings of this kind are very stimulating. The speakers have told us the evils that exist,

and have not dwelt too much on the happy side of the picture. They have gone to the root of some of the evils that undoubtedly exist. I was particularly interested in what Dr. Brooks had to say about the importance of dental infection in systemic disease. As one who is particularly interested in arthritis and rheumatic conditions, my own feeling is that, certainly in private practice, focal infection about the teeth has been overstressed as compared with, for instance, the tonsils. Perhaps in general hospital work and in outpatient clinics dental infection plays a more important part; I think it does. Certainly in private practice, in my own personal experience, infected tonsils and sinuses both play a more important part in rheumatic conditions than infected teeth, though of course teeth do play a rôle. Perhaps the reason that dental infection has been overstressed, and so many perfectly good teeth removed in the past, has been the difficulty of determining when a tooth is infected. This is one of the great problems we face today. We can generally tell when a sinus is infected, and it is fairly easy to tell when a tonsil is infected, but I am sure we all agree that we cannot say dogmatically when a tooth is infected—when it is actively infected, and when it is not.

Is a tooth infected when there is a zone of rarefaction around it? I think most of us are doubtful about that point. Is a tooth infected because the x-ray shows an apical shadow? We know granulation tissue will give a shadow; we know a healed scar will give a shadow. I might go even further and ask: Is a tooth infected because bacteria may be cultivated from its apex? You are all familiar with the book that Dr. Russell L. Haden has recently written on dental infection, in which he states that streptococci can often be recovered from the roots of vital teeth. This fact brings up the question of technic in preparing cultures from extracted teeth. It has always seemed very difficult to get accurate bacteriology from the roots of an extracted tooth, even when the most careful technic is used. For that reason I have advocated culturing the tooth from the inside, rather than from the outside; that is, cracking off the tip of the root and culturing from the canal. Then you may say: "It is all very well to get streptococci from inside the tooth, but does that necessarily mean that they are doing the patient any harm? If they are on the inside and not on the outside, why worry?" The whole question is beset with many problems that are hard to solve. We know that inflammatory tissue is not necessarily an evil. Perhaps it is better to have granulation tissue guarding bacteria at the root of a tooth than to have them there without any reaction going on against them. I don't know how the problem will ultimately be solved. It is one of intense practical importance. We don't want to excise tissue around the tooth,

but I quite agree with Dr. Schamberg in saying that we certainly cannot accept the dictum that all devitalized teeth are a menace. I certainly am not willing to go that far. I think that is the present sentiment of the medical profession and the dental profession as well.

Henry Hall Forbes, M.D. (New York City): I think the main point in the discussion is the coöperation now existing between dentists and medical men. There would seem to be unanimity on this question. I congratulate both the dentists and the medical men that we have arrived at that point in our scientific programs and our practical work. May I also speak as a member of the Boards of Directors of two of our new dispensaries. To the doctors of dentistry I wish to say that, in these institutions, the outstanding clinics are those in charge of members of your profession. Forty years ago a dental clinic in any dispensary was unknown. Today, however, a dental surgeon is a necessity. We were very proud to add the dental department to our groups of clinics and we value the opportunities for consultations. Both dental clinics are the best clinics in our two dispensaries.

Walter Anderton, M.D. (New York City): The essential factors in cooperation between medicine and dentistry in prevention of disease have two rather important aspects, one depending on education, the other on conference. I am ashamed to say that the medical men, as Dr. Schamberg has pointed out, are nowhere nearly so well educated in dentistry as the dental men are along medical lines. I think it is high time that in every course in medicine they should teach the physiology and diagnosis of dentistry for the medical man. Conference between dentists and medical men is extremely important. Conference is facilitated in hospitals by written records and recommendations for the proper care of each patient, and for the prevention of disease through dentistry. In private practice conference may be by telephone and face-to-face meetings, as well as in proper correspondence about individual patients. There may also be conference in regard to public health matters.

Justin D. Towner, D.D.S. (Memphis, Tenn.): A statement by Dr. Schamberg is similar to one I made today to Dr. Walker to the effect that the physician has less knowledge of dentistry than the dentist of medicine. I am reminded, in this connection, of the effort we are making in dental education at the University of Tennessee through the Department of Dental Pathology. By means of chemico-pathological laboratories, we are connecting the medical and dental departments in respect to path-

ology incident to both professions. The two meet in the various clinics, especially the "O. P.," and there apply the knowledge gleaned from either source. In this way we hope to strengthen the link that must eventually connect the two professions, since this is the common ground upon which we meet. We are trying to educate mouth physicians as well as dentists. The man of the future who justifies his existence as a dentist will be more akin to his brother physician in that, as a mouth physician, he will be qualified not only to speak the language of medicine, but also to coöperate with the physician in rendering a more distinct health service to the community.

I am frequently asked, as I go about the country: "What is the matter with dentistry?" Though I see an awakening, as you perhaps do, I am reminded of this typical southern story. Two fellows were riding mules along a dusty road when they suddenly came to a railroad crossing. One mule took the ascent, crossed the grade, and made the descent with perfect decorum. Soon the rider noticed that his companion had been left behind; so turning his mule he rode to the crest of the elevation, and observed the other mule bucking and backing with his tail between his legs while the rider spurred, whipped, and swore. Presently he said: "John, why don't you come on?" To this John replied: "Come on? I've got all I can do to stay where I am." Fortunately, while trying to stay where we are, we have rather unconsciously built a firmer foundation upon which to erect a more tenable theory and practice of dentistry. I am glad to hear Dr. Rice's opinion of this phase of our education and to note the disposition of his school in respect to it. This is definite evidence of a broader conception of the ultimate in dental education.

Henry W. Gillett, D.M.D. (*New York City*): I want to refer again to what I said last year in discussing Dr. Cecil's paper.[3] All of us, when we talk about dental infection and mouth foci, tend to concentrate on root-end foci only, and to overlook the fact that, in the advanced cases of pyorrhea or periodontoclasia, there are open ulcers that may mean anything from one to two or even three square inches of pus-producing surface pouring their product into the mouth, whence it goes to the alimentary canal. There is no escape from the conclusion that pus, bacteria, and ptomaines are not only absorbed by the congested tissues of the walls of pyorrhea pockets, but that they are also forced into them during functional use of loosened teeth. The lymphatic drainage of these tissues is the same as from root-

[3] Gillett: *Journal of Dental Research*, 1930, x, p. 157.

end areas; and the point made by Dr. Brooks, as to the inference to be drawn from involvement of the cervical glands in diagnosing mouth foci, is an important one.

I am familiar with the conditions of the survey of a school in Glen Cove, to which Dr. Walker referred, and I want to emphasize the importance of the deductions to be drawn from it and from the Boys' Club Survey. The fact that 94 percent of the 580 Glen Cove pupils were found to have already reached, or very closely approached, the stage of established mouth foci is a serious indictment of the present standards of health service for children. The most ominous finding in the report is the fact that of 41 kindergarten children only two had mouths that could be rated as safe from focal infection. Evidently dental health-service has either been non-existent for these children, or has failed to function. Intelligent application of approved methods of reparative dentistry could have prevented establishment of most of the foci reported. Many dentists and parents fail to realize the great importance of simple reparative service for every child's tooth in need of it, within three months of its eruption. Very often the economic factor prevents utilization of the known values of early dental service, even when they are recognized. The one hope of effectual prevention of mouth disease, and of minimizing resultant secondary disease, lies in discovery of feasible methods to induce development of teeth free from physical defects and able to resist caries. We now feel that the secret lies in the field of prenatal diet for the mother, diet for the child during tooth development, and in intelligent selection of diet through life.

The most important part of Dr. Walker's message lies in the emphasis he places on the need for prevention of oral disease, and for coöperation between physicians and dentists to further the development of prevention, and to advance the value of mouth health-service. Dr. Brook's sympathetic understanding of the pathology of the mouth, and his evaluation of dental service, are welcome evidence of a trend toward better coöperation.

Ben Witt Key, M.D. (New York City): I graduated from the University of Pennsylvania twenty-two years ago, and for the last twenty-two years, and for four years while there, the medical men had their hats off to the dental students as well as to each other. When it comes to the relationship of dental infection and ocular disease, the two branches of medicine are very intimate. We fight over diagnosis every day. I believe there is no difficulty I have to face over which I tremble so much, in arriving at a decision, as the problem whether this or that condition of the mouth may be the cause of an ocular condition. The two extremes of this situation seem to

be most important, because the other phases fall between them. One is the necessity for a correct diagnosis; the other is the carelessness with which dental or mouth infection is disregarded in ocular disease. A few months ago there came to my office a woman recurrently blind in the left eye for the past two months, and for which all of the teeth on the left side of the upper jaw had been removed. She was forty-five years old. Her vision was restored to normal after placing her under atropine. In other words, she had a spasm of accommodation, a rare occurrence at forty-five. This is a fair example of the first extreme.

A. G. Richburg, D.M.D. (*Boston, Mass*): It is a distinct relief to learn that at least some members of the medical profession are emerging from their shells. All of us in the course of our active practice have encountered non-appreciation on the part of the physician and surgeon.

Frank A. Delabarre, D.D.S., M.D. (*Boston, Mass.*): I feel that coöperation between the two professions is absolutely essential. If we think in terms of health and health service, it must be acknowledged that the best effort is expended on children in preparing them for life's battles to preserve health. I think the pediatrician cannot give full service to the child without the coöperative service of the dentist, and vice versa.

The figures given by Dr. Walker, on the occurrence of caries, were intensely interesting. They can be duplicated by any man who has had dental clinical experience. I examined fourteen pre-school children at the Forsyth Dental Institute the other day in fourteen successive chairs, and found an average of two deciduous molars lost per child. We are making an examination of third-grade children in Massachusetts. The preliminary tabulation of the available reports shows the existence of an average of eight cavities and two abscesses per child. If that is true in the eight-year old child, the question arises, when does it begin? I assure you that it begins very early in life, and dental conditions should be more adequately taken care of. We are not yet able to prevent the occurrence of dental caries. I am confident that the disclosures of research will enable us to do so. Meanwhile we should give early, systematic, and periodic attention to children.

Edward Frankel, Jr., M.D. (*New York City*): It was suggested, I believe, that the younger dentists are eager to learn. I have found them so. From time to time I have invited many younger dentists to one of my otolaryngologic clinics, and it is pleasing to see how keen they are to master the tech-

nique of routine clinical procedure. Two young dentists of my acquaintance have learned to make complete and thorough rhinological, naso-pharyngeal, and laryngological examinations, including the diagnostic employment of the electrically-illuminated naso-pharyngoscope. We otolaryngologists, on the other hand, make it a practice to examine every mouth for trouble with the teeth, and try to coöperate as much as possible with the dentists in the department.

Dr. Walker spoke about records and reports. I wish this matter could be brought home to every one of us. We would be one grade nearer Utopia if all physicians and dentists interchanged records and reports on cases they have in common. In my personal practice it is an invariable rule to forward, at once, a complete report to a dentist who is working simultaneously with me on a case. Similarly, the dentist is called upon for his report. Thus we obtain intelligent coöperation to the ultimate benefit of the patient. Dr. Brooks referred to the two professions having meetings in common; when and when not such meetings would be useful. To be sure, it would be useless for a dentist who wasn't particularly interested in obstetrics to attend a meeting concerning general obstetrical matters for the sake of gleaning such few points concerning prenatal care as might be touched upon during the course of the evening. But as to fields in common, such as dentistry and otolaryngology, or dentistry and metabolism and nutrition, or dentistry and gastro-enterology, combined meetings are very important for both professions.

I have made some notes concerning the essential factors in the coöperation of physicians and dentists in the prevention of disease. They must speak the same language and have the same fundamental conceptions of disease. Physicians must be acquainted with dental pathology and oral hygiene. Dentists must be familiar with fundamental clinical medicine. In other words, physicians and dentists must meet on the same intellectual level. Dentists must approach problems of preventive dentistry in the same manner that problems in preventive medicine are approached; namely, through experimental methods in bacteriology, physiology, biochemistry, experimental surgery, and so forth. Dentists must work out such problems as dental caries and its prevention, periodontoclasia and its prevention, malocclusion and its prevention, erosion and its prevention, and the importance of pulp and periapical infection as causes of systemic disease. There is special need for clinics, with both dentists and medical men on the staffs, for the regular physical examination of well persons, and the treatment of cases of incipient disease as well as that of advanced disease.

THE MODERN CONCEPTION OF BONE FORMATION AND ITS RELATION TO SURGERY[1]

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Not so many years ago the formation of bone in the adult body was universally assumed to be the result of specific activities of particular cells—the osteoblasts or bone-forming cells. Variations in the rate and amount of bone production were explained as due to variations in the functional activity of such cells. This functional activity was considered as being dependent upon several factors intrinsic to the organism as a whole, and upon externally applied stimulants and deterrents. Today, through clinical and experimental study, many of us have reached a different conception of bone formation. Bone is to be regarded, in this conception, not as a result of specific cell-activity, but as a biochemical phenomenon independent of such direct cell-participation. Bone production in the adult animal may be regarded as the deposition of calcium compounds in growing granulation-tissue incident to the biochemical status of the part. If it so happens that the deposition of this calcium occurs in tissue that is dead, which presents no living morphology, the process is known as calcification.

Anything here set down is to be construed as applying specifically to the adult, and not to the embryo, infant, or young and growing child. There is still reasonable doubt as to the existence of a specific bone-forming cell in the growing child and in the infant, and much reason to believe that such cell specificity exists, at least for a time, in the embryo. Eben Carey, of Marquette University, is inclined to deny the existence of such specific cells even in these periods, believing that the apparent specificity of cells may be largely explained by

[1] Read at a meeting of the American Stomatological Association, Columbia University Club, New York City, March 10, 1931.

tissue-tension factors of various sorts and by cell environment. He has produced experimental evidence to show that smooth muscle may be changed into striated muscle by variations in these factors. If this evidence is to be accepted, the conception supported by it is certainly worthy of consideration. Strangeway and Fells were able to show that the femur anlage of the chick embryo, removed by microdissection and transplanted to artificial media, grew roughly in the shape of the femur, and increased in size over a considerable period. The anlage transplanted at the three-and-a-half-day stage of development failed to exhibit any epiphyseal differentiation and never produced phosphatase, a ferment advanced by Robison as being the active factor in the calcium deposition of bone formation. When, however, the transplantation was delayed until the embryo reached the six-day stage, both epiphyseal differentiation and phosphatase production occurred. These findings may well fit in with Carey's conception of the factors involved in the apparent development of specific cell-function.

As exemplifying the difference between child and adult I can cite a very well known disease, the familial or hereditary type of multiple cartilaginous exostoses. This is characterized, in addition to the appearance of the multiple growths on the long bones, by associated epiphyseal disturbances resulting in relative shortness of the extremities as compared with the body, shortening of the radius, and microscopically by epiphyses showing cells of abnormal size, with distorted arrangement and abnormal staining qualities. Groups of these cells are transplanted into the periosteum at the epiphyseal line, and give rise to the bony cartilaginous growths on the shafts of the long bones. At puberty the whole disturbance ceases quite abruptly. Later section reveals perfectly normal bone, which remains perfectly normal thereafter.

A number of observations have influenced our doubts as to the existence in the adult of a specific osteoblast. Frequently in sectioning chronically diseased tonsils, vessels in the late stage of arterial sclerosis, thyroid and breast tumors, scar tissue, inflammatory lesions of the gastric wall, and other chronic tissue-disorders, we find that bone has developed. Trauma to muscle may result in bone formation in the muscle. It is well known that bone can be readily produced

if the intrinsic circulation of a rabbit's kidney is ligated, leaving only the capsular supply. Transplantation of fascia lata into the bladder wall, as demonstrated by Neuhof, almost universally results in bone formation. It would appear that any explanation of bone formation in the adult must account for the existence of the bone-forming factors in these instances as well as in normal bone-growth and bone-healing.

Our studies of fracture repair over a number of years have led to considerable doubt as to the existence of an osteoblast in the adult body. When a bone is broken there is a certain amount of periosteal tearing and soft-part damage. From the torn bone and soft parts there is hemorrhage, which lies between the bone ends and permeates all the tissues that have access to the fracture-site by reason of the soft-part injury. The ends of the bone at the site of fracture die. I say this advisedly, meaning that within a short time there exists no cell that takes any nuclear stain, leaving an apparently inert mass of calcium. The hemorrhage clots, as it does anywhere else in the body, forming a fibrin network between the bone-ends themselves, and between the bone-ends and the accessible soft parts. This fibrin network is an important factor in bone formation. An adsorption affinity for calcium by the hyaline of hyaline cartilage and by the collagen of ordinary connective-tissue has long been known. Such an affinity for calcium on the part of fibrin may well exist. We now have experiments under way, which, though incomplete, tend to show the existence of such an affinity, a matter which may help to explain why the calcium that is utilized in fracture-healing stays at the site of fracture. Into the fibrin network, cells grow from the surrounding tissue on all sides—granulation-tissue organization. This is the healing of a fracture. The fracture heals, just as does any other tissue, by the growth of granulation tissue. So-called delayed union and non-union really represent delay or failure in the deposition of calcium in this tissue to form bone. In our previously published studies we have shown that as much as four-fifths of the healing tissue may be derived from tissues outside the bone, the soft parts having access to the fracture site by reason of the damage done at the time of fracture.

It is our belief that the calcium for deposition in this granulation tissue to form bone is derived, for all effective purposes, from the ends of the fractured bone, and not directly from the blood-stream. Clini-

cally, our doubt that the blood stream is the source of the calcium utilized in the healing of a fracture has been intensified by a number of observations, which seem to show, for instance, that non-union or delayed union—if we exclude mechanical factors such as interposition of tissue between bone-ends, and chemical factors such as infection—is a phenomenon of places in the body rather than of individuals. Such places in the body are the neck of the femur, the junction of the lower and middle third of the tibia, the middle third of the humerus, the lower third of the ulnar shaft, the navicular bone in the carpus, the head of the radius, the base of the fifth metatarsal, and other sites that consistently show slow union, frequently non-union. I have seen a patient who, in falling from a height, fractured both tibiae in two places—at the junction of the upper and middle thirds, and at the junction of the lower and middle thirds. Both legs were identically treated by pin traction. Both upper fractures showed solid bony union within five weeks; the lower fracture on one side was a delayed union at nineteen weeks, and on the other side a non-union requiring operative interference. Similarly in fractures of the tibia of this type, accompanied by fracture of the fibula, it is well known that the fibula almost universally unites rapidly and solidly. It is difficult to reconcile a disturbance in general body chemistry with such findings in any individual.

Fractures of the femoral neck of the intracapsular type, regardless of the general condition of the patient, his body chemistry, the decade in adult life in which he belongs, or any factor except the location of the fracture, present at the outset a prognosis of a large percentage chance of non-union, or even of absorption of the neck. Yet in the same patient, if the fracture lies but an inch-and-a-half away, in the intertrochanteric region, it shows so rapid and adequate a bony healing that we are accustomed to say it does so "despite treatment." The individual as such seemingly plays no part in the story. Similar difficulty in envisaging the patient's body chemistry as essentially involved in the story is experienced when one finds osteomalacia with a blood calcium of 6, and a blood phosphorus of 1.2, running a negative calcium balance, yet healing a fractured femur-shaft in some five weeks, as we have more than once observed. In our clinical experience rachitics have shown normal bone-healing. Along the same lines

of observation we have been unable to demonstrate, or to find consistently demonstrated by others, any definite effect on fracture-healing by the administration to the patient of treatment affecting his general calcium and phosphorus metabolism. These observations embrace the study of a host of things—cod liver oil-viosterol-calcium in various forms and various modes of administration, the use of mercury and carbon arc-light, glandular extracts, and many other therapeutic measures.

In a study of healing fractures at various stages, it became obvious that not only did the injured bone die to a certain extent, but also that such dead bone was obviously demineralized and autolyzed, and that the tissues about the fracture-site contained calcium to a far greater concentration than those further removed. The possible bearing of an adsorption affinity of fibrin for calcium must be kept in mind as a factor in holding calcium that has been freed from the bone-ends at the site of fracture. An experimental series was undertaken to investigate the possible rôle of the calcium autolyzed from dead bone at the fracture site. The basis of the experimental procedure was the exsection of 2.5 cm. of a dog's radius with its periosteum, leaving the ulna intact to maintain the gap. When the gap was left vacant, fibrous union only was attained between bone ends, with no bone production excepting a slight amount *about the apparently dead and autolyzing bone ends.* When the removed section was chopped into small fragments, and these dropped back into the gap, solid bony union resulted, the primary nidus of bone formation being *about the bone ends, dead as before, and about the individual chips which were microscopically dead and autolyzing.* Even after these chips had been suspended in boiling water to insure death, the same thing was true. When these chips were partially decalcified (and then de-acidified) before being put back in the gap, but little bone-formation occurred. When they were completely decalcified before being put back, *no bone-formation occurred.* All these animals were on identical diets, and their blood chemistries were normal. *When the section of removed bone was completely discarded,* and the gap filled with powdered organic calcium (di-hexose phosphate), or with inorganic calcium (triple phosphate and carbonate), *bone-formation occurred,* as when the chips had been inserted. Apparently, in the presence of granulation-tissue growth

into the gap, four-fifths of which came from soft parts outside the bone, the essential factor to determine whether calcium was deposited in that tissue to form bone was the presence or absence of a *local* calcium supply. The *life* of the chips was apparently a matter of indifference, and any artificial *local* calcium supply could be substituted for the chips.

Studies of healing fractures also brought out the fact that, in new forming-bone, there is no correlation between cell morphology and intercellular substance. Hyaline and fibrillar matrices, with and without calcium deposits, indifferently surrounded cells that morphologically might be fibroblast, cartilage cell, or osteoblast. Further study showed that the morphology of granulation tissue and that of early bone were identical, except for the presence of calcium in the latter. The later morphology of the bone is readily and logically explainable in accordance with physical laws—of stress and strain as exemplified in Wolff's law, and by surface tension as exemplified in the arrangement and morphology of the cells grouped along the edges of trabeculae and commonly called osteoblasts. Experimentally it was found as well that the presence of excessive fluid at a fracture-site interfered with healing (low melting-point gelatin), whereas the presence of an abundance of fibrin (introduced as fibrin from the animal's defibrinated blood) promoted healing. This should not be surprising, since we know from tissue-culture work that excess of fluidity in the medium interferes with tissue growth, and that the presence of a profusion of fibrin or other solid support accelerates the rate and increases the extent of tissue growth. In addition, the possible significance of fibrin as a calcium-fixing substance (through adsorption) must be kept in mind. The bearing of these facts on the presence of excessive edema at a fracture site is evident.

On the basis of the experimental series in which a local calcium source as a necessity for bone formation seemed to have support, we then repeated a series of experiments in which, some years ago, we failed by trauma and circulatory disturbance to cause myositis ossificans. By duplicating the unsuccessful experiments, but at the same time introducing into the muscle local sources of both organic and inorganic calcium in the forms in which they had been utilized in the radius gap, we were able to produce experimental myositis ossificans.

Apparently wherever we produced tissue death, granulation-tissue replacement, adequate local calcium supply, and (clinically and experimentally increasingly evident) an adequate circulatory status, bone-formation occurred, whether osteoblasts existed in the region or not. To talk of cell metaplasia under these circumstances is a *post hoc, propter hoc* type of reasoning, and begs the question. The adequate circulatory status is involved, in our opinion, not as a nutritional condition, but as a factor in determining the tissue-fluid reactions at the site. Quantitative and qualitative blood and lymph circulatory-variations may produce definite and in fact fairly marked variations in the pH of the tissue-fluids in the region affected. There is a good deal of evidence to support this view. Whether we feel that the mechanism of the actual deposition of the calcium is that of a precipitation, which seems doubtful, or the result of ferment activity, as of the phosphatase predicated by Robison, which seems much more likely, the pH of the tissue-fluids may in either instance be a matter of prime importance. We feel that circulatory variations of quantitative and qualitative nature may play an important part in the deposition of available calcium to form bone, or the absorption of calcium that constitutes decalcification of bone, without the necessity of predicating a specific cell-activity in either instance.

Taking Robison's demonstration of phosphatase in growing bone as a basis, Dr. Margaret Murray and I have shown that precipitation of a calcium monohexosephosphate from an aqueous solution of calcium, in the absence of a phosphatase, can be accomplished, in amounts and at a rate sufficient to be comparable to that in the tissues in bone formation, only when the concentration reaches that of practically one hundred times the normal-serum calcium-concentration, and then at a pH of 9.5—a pH incompatible with cell life. The same degree of precipitation from the same concentration can be accomplished by the introduction of a phosphatase, obtained from dead bone after Robison's water-extraction technique, at a pH of 8.2, which is quite compatible in our experience with cell life and active growth. When such precipitation is made to occur in a plasma medium augmented by the monohexosephosphate of calcium, by either mechanism, it is interesting, and possibly significant in view of what has been said of the rôle of fibrin in calcium-fixation at the fracture-site, to note that

practically all the precipitated calcium lies in the fibrin network, and along its edges, and little or none in the fluid portions of the clot. When we grew various tissues in such a plasma medium in the presence of one hundred times the normal-serum calcium-concentration in the form of monohexosephosphate at a pH of 8.2, no precipitation occurred about the cells unless a phosphatase was introduced, *or unless the cells were allowed to stand long enough to die.* The pH-change during this standing process was not sufficient to account for the precipitation. This *was true even when callus was the tissue cultured.* Does this mean that cell death—of any sort of cell—is the source of the ferments that precipitate calcium, provided the form of calcium affected by the various kinds of ferments freed by different cells happens to be present? This phase of the problem is under investigation.

Only the salient features of the investigations have been presented. It is a complicated story from the clinical, biochemical, and morphologic histological sides. From the studies so far, we have been led to feel that the following (1–4) expresses our present conception of the possible conclusions of clinical value for which we have reasonable support:

(1) New bone-formation in the body of a human adult is accomplished by death of tissue, granulation-tissue replacement, local concentration of calcium by any mechanism whatsoever, and proper vascular status.

(2) The vascular status of any site, as concerned in bone-formation, includes the lymphatic circulatory-status and is involved, not from a nutritional standpoint, but from a standpoint of tissue-fluid biochemistry. The circulatory changes involved may be either qualitative, quantitative, or both.

(3) This vascular status may explain why clinically and experimentally the circulatory factor is so universally involved in bone-formation.

(4) Non-union and delayed union, except as the result of mechanical interference or chemical interference, are misnomers; they are actually failure or delay in the calcification of healing tissue, and are due to purely local causes, largely circulatory, and without regard to the patient's age, general health, or blood chemistry.

Clinically we have applied to non-union the four premises for bone-formation above enumerated, including the artificial source of pow-

dered calcium, and so far have had universally successful results. In bone cavities following osteomyelitis and bone cysts, we have done the same thing. The technique has been published. The cases are relatively few—not more than fifteen. We are therefore presenting no clinical cases, but merely a viewpoint which in our hands, in a few cases, has been successfully applied.

From the standpoint of dental and oral surgery, and of orthodontia, such a conception of bone-formation and bone-absorption, independent of cell activity, but dependent on physico-chemical factors more amenable to control than the little understood cell metabolism, must have a decided influence. It opens a field of investigation which, I am certain, offers a wide range of clinical application.

MEDICO-DENTAL CASE RECORDS. X. BRONCHIAL ASTHMA[1,2]

A Clinico-Pathological Study

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New York City

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I. INTRODUCTION

Definition of bronchial asthma:[3] a reaction of an anaphylactic nature in sensitized persons, characterized by swelling of the nasal or respiratory mucous membranes, increased secretion, and spasm of the bronchial muscles with dyspnoea.

Etiology. Asthma may develop at any period of life. Children and young adults are usually most susceptible. Males are affected twice

[1] The previous reports were published in the *Journal of Dental Research:* (1) 1926, vi, p. 283; (2–4) 1927, vii, pp. 115, 275, 457; (5–6) 1928, viii, pp. 73, 579; (7) 1929, ix, p. 89; (8–9) 1930, x, pp. 173, 675.

[2] Presented at a meeting of the New York Section of the International Association for Dental Research, Dental School, New York University, May 21, 1931; *Journal of Dental Research*, 1931, xi, p. 639.

[3] Osler, Sir William: The principles and practice of medicine, *10th ed.* (revised by Thomas McCrea); D. Appleton and Company, New York and London, 1925. Stevens, A. A.: The practice of medicine, *2nd ed.;* W. B. Saunders Company, Philadelphia and London, 1926.

as frequently as females. Hereditary influence is a factor of importance. In one series of 400 cases, a family history was found in 48 percent of the cases. When both parents have asthma, all children tend to have it; there are many instances on record of the transmission of the susceptibility from generation to generation. Patients, as shown by the skin test, may be sensitive to one or more proteins, the most common being proteins from animal hair, food, pollen, and bacteria. Many patients are sensitive to more than one protein (multiple sensitization). Most patients having bronchial asthma are sensitive to pollens, cat hair, horse dandruff, a few of the common foods, and staphylococci or streptococci. Frequently the disease is closely related etiologically to a focus of infection. It has been shown that when asthma develops during the first year of life, it is usually due to milk; during the second year, it is usually caused by eggs or cereals, although it may be caused by bacteria; in childhood after the second year, it may be induced by food, infection, animal emanations, or pollen; in adult life, it is almost always excited by bacteria (staphylococci, streptococci, diphtheroid organisms, etc.). The various proteins used in sensitization skin-tests comprise a long list.

Symptoms. The attacks usually begin at night and may come on suddenly. The patient is seized with dyspnoea and a feeling of impending suffocation, which compel him to assume an upright posture. The expression of the face becomes anxious, the eyes may protrude, and the skin becomes covered with cool perspiration. The breathing, especially expiration, is labored and often accompanied by loud wheezing, owing to contraction of the muscular fibres of the bronchi and vesiculae of the lungs. The respirations, however, are not increased. The attack may last from a few minutes to several hours. When severe, there are signs of defective aeration, cyanosis, feeble pulse, and cold extremities. Coughing is difficult; tight and dry at first, and then more violent, with expectoration of distinctive sputum.

Physical signs. As the dyspnoea of asthma is essentially *expiratory*, the chest is abnormally distended; the upper ribs are elevated, and the diaphragm depressed. The percussion note is normal or hyperresonant. Auscultation reveals numerous sonorous râles of varying quality and intensity, and occasionally a loud wheezing respiration with a prolonged expiratory sound.

Diagnosis. The picture of asthma is usually thus distinctive, but to determine the particular protein that acts as the etiological agent requires careful differential tests by means of skin-reaction tests.

Prognosis. In early life the prognosis depends largely upon the possibility of an *etiological diagnosis*, and the desensitization or removal of the source of irritation. Bronchial asthma rarely is fatal; but if the disease has persisted for some time, the existing emphysema and chronic bronchitis render the outlook less favorable, as dilatation of the heart may supervene and be the cause of death.

II. CASE R-2 (80): FIRST ADMISSION

General history and physical examination

Young man, 23 years old, photographer by vocation, admitted to private pavilion of hospital,[4] *October 14, 1930*, for observation and diagnosis. Chief complaint: shortness of breath. Had no idiosyncrasies; used neither alcohol nor tobacco; accustomed to work hard; appetite good; frequently used cathartics; slept well. Best weight, 178 pounds; average, 155 pounds; present weight, 140 pounds.

Environment. Environmental factors negative: lived on third floor of private house in good neighborhood; plenty of sunshine and good air; no stable in vicinity; slept on feather pillow and hair mattress; occupation as photographer involved exposure to acetic, citric, hydrochloric, and sulphuric acids, and various salts of sodium and potassium.

Family history. Patient's father died from aneurysm of aorta at 53; mother and two brothers living and well; mother and one brother had asthma —both, according to history, cured by removal of infected teeth.

Past medical history. Patient had measles, chickenpox, and croup in childhood; influenza once; pneumonia in 1924; about three colds a year, usually one week in duration; no history of venereal disease, diabetes, tuberculosis, or exanthematous fevers; tonsils and adenoids removed; occasional headaches; wore glasses; no history of palpitation, tachycardia, or indigestion.

History of present illness. Patient always well until year ago; initial attack of bronchial asthma, *September 25, 1929*, starting at 2 a.m., at home in bed, following change in weather; lasted one hour. Following morning went to work; that night developed what he thought was severe cold—slight elevation of temperature, cough, coryza, with much muco-purulent

[4] The Fifth Avenue Hospital, New York City.

sputum having foul odor; took cathartic and aspirin. Following day worse; consulted physician; condition diagnosed as asthma. Under treatment, condition improved; *October 7* became worse. *October 10:* admitted to hospital for ten days; received vaccine made from sputum, followed within 24 hours by severe reaction; severe wheezing and prostration. *November 15* to *December 15:* was free from symptoms, but had recurrent attacks in *January, 1930, June,* and on *October 2.* During this period remained away from business; with this prolonged rest felt improved in general health. Present attack began *October 10;* daily elevation of temperature to 102; no chills; much muco-purulent sputum; no hemoptysis; marked shortage of breath. Thinks dyspnoea due to difficult inspiration; took adrenalin regularly with relief of symptoms, but with consequent "shaky feeling and pounding of heart." All attacks occurred in home, lasting from six to eight days; seem related to change in temperature, humidity, and wind velocity.

Physical examination. General appearance on admission: pale, not acutely ill; nutrition, fair; temperature, 99; pulse, 100; respirations, 20. Blood pressure: systolic 130 mm.; diastolic, 80 mm. *Skin:* warm and moist; no abnormal pigmentation; slight cyanosis. *Eyes:* normal reaction to light and accommodation. *Ears and nose:* negative. *Teeth:* "good condition."[5] *Pharynx:* fauces, injected; tonsils, removed. *Neck:* no adenopathy. *Thorax:* symmetrical; expansion fair and equal. *Lungs:* good resonance throughout, possibly somewhat increased; many inspiratory and expiratory squeaks; moist râles. *Heart:* rhythm normal; no accentuation, reduplications, rubs, or murmurs. Sounds at base rather distant. *Report of roentgenologist.*—"Stereoscopic films of chest in postero-anterior direction show extensive peri-bronchial thickening throughout both lungs, more extensive in right lung but more localized in left, on level with second interspace. Small patch of infiltration in this region. Root tissue shows marked increase around both roots. Believe these changes results of extensive peri-bronchial process, with weight of evidence in favor of infection. At present, believe lesion is non-tuberculous; but, on account of small patch of infiltration in second interspace, upper left lung, believe it wise to recheck chest a month hence. *Heart:* small, and vertical type; aorta, normal; pleura, no exudate." *Abdomen:* negative. *Extremities:* negative; reflexes active and equal.

[5] There was no special examination of the teeth, and no dental roentgenograms were taken, at this time. The note of "good condition" was the opinion of the physician.

Clinical pathology (laboratory reports)

Temperature: first two days after admission: ranged from 99° to 100.8°; after the second day, within normal limits, or slightly subnormal. *Pulse rate:* slightly accelerated. *Urinalysis:* amount, normal; specific gravity, 1.026; reaction, acid; albumin, trace; sugar, absent; white blood-cells, few. *Hematology:* hemoglobin, 110 percent; red blood-cells 5,300,000; white blood-cells, 19,000; polymorphonuclear leukocytes, 79 percent; lymphocytes, 17 percent; eosinophiles, 4 percent. *Blood chemistry* (mg. per 100 cc.): urea nitrogen, 17.1; sugar, 85.7. *Sputum:* no tuberculosis bacilli; many streptococci in long chains.

Diagnosis and treatment

Diagnosis: bronchial asthma. *Treatment:* hepar sulphate every two hours; general diet. Remained in hospital ten days; discharged *October 24, improved.*

III. SECOND ADMISSION

Interval history

Two days after discharge from hospital, suffered severe recurring asthmatic attack requiring adrenalin for relief; reentered hospital *October 26.* No change in general physical examination. Chest, numerous râles; temperature, within limits of normal variation; pulse rate, slightly accelerated. Roentgenograms of sinuses, no evidence of infection of exudate. Normal development. *Complete* sensitization tests for foreign proteins: sensitive only mildly to cat hair, dog hair, egg yolk, tomato, and horse dandruff.

Report of dental consultant

Clinical examination: light deposition of salivary calculus; mild simple gingivitis; no evidence of Vincent infection. Much restorative dentistry, all well executed. All teeth respond within normal limits to pulp test for vitality, except right maxillary lateral incisor; latter no response. *Roentgenographic examination:* right maxillary lateral incisor pulpless tooth; incomplete root-canal filling; chronic rarefying osteitis at apex—cystic degeneration; all other teeth and surrounding bony structure appear natural. *Comment.* Right maxillary lateral, pulpless tooth, probably constitutes active focus of infection; may be aggravating or etiological factor in general condition. *Recommendation:* remove right maxillary incisor tooth; culture to be taken for skin sensitization tests, and held for vaccine.

Treatment

Surgical.—November 11: right maxillary lateral incisor removed; local anesthesia (procaine 1 percent, with epinephrin 1–40,000). Condition at apex: chronic rarefying osteitis with cystic degeneration. Culture from apex: streptococcus viridans recovered, vaccine prepared; no exacerbation following operation. Culture from nose, nasopharynx, and sputum. *Medical.*—Administration of hepar sulphate resumed every two hours; also Lugol solution, gtt. v, t. i. d. *Diet:* general, excluding egg and tomato, all forms. Additional *sensitization tests:* autogenous vaccines prepared from cultures taken from sputum, nasopharynx, and apex of infected tooth; moderately severe skin-reaction for each vaccine, patient reacting definitely to vaccine from infected tooth. Patient improved; more comfortable, and relieved from acute symptoms of asthma shown when admitted. Discharged "improved," *November 14.*

IV. THIRD ADMISSION

Interval history and physical examination

Several days after patient left hospital, had asthmatic attack lasting only few hours. Evening of *November 20:* had another severe attack; physician recommended return to hospital; readmitted, *November 20.* Physical examination: no additional findings. Chest: hyperresonant throughout; filled with asthmatic râles; wheezes. Hematological examination: improvement in blood picture; hemoglobin, 102 percent; red blood-cells, 5,100,000; white blood-cells, 9,800; polymorphonuclear leukocytes, 77 percent; lymphocytes, 18 percent; mononuclear leukocytes, 3 percent; eosinophilic leukocytes, 2 percent. Temperature never above normal, ranging from 97° to 98.6°. Pulse rate accelerated upon entry (110); later remained within normal limits except for occasional rise. Respiratory rate, normal.

Treatment

Given adrenalin for relief of acute attack when admitted; received regularly antimonium arsenicosum q. l. h.; for two weeks received spiritus frumenti ℥ i and sodium salicylate gr. x at bed time. Autogenous combined vaccine prepared from cultures taken at previous admission: staphylococci from sputum, 2.5 units; staphylococci from naso-pharynx, 2.5 units; streptococci (viridans) from infected tooth, 5 units (10 units in 1 cc). *December 1:* received 0.03 cc. of combined vaccine; every third to fifth day, doses in slowly increasing amounts. In bed about 10 days; no attacks until December 12; then slight one. Improved steadily, discharged *January 6, 1931.*

Vaccine administrations continued: increasing doses until *April;* then 0.26 cc.; afterward at greater intervals until *June.* No return of severe attacks. Benefited greatly by combined elimination of oral focus of infection and administration of mixed autogenous vaccines.

V. SUMMARY AND DISCUSSION

This record of a young man, 23 years old, who had several severe recurrent attacks of bronchial asthma, presents interesting features from the dental viewpoint. When first admitted to the hospital, for observation and diagnosis, he was given the usual complete physical examination and the complete series of protein skin-tests. Three of these tests were only mildly positive. At a later admission, following a severe recurrent attack, special attention was directed at the possible sources of focal infection. An infected tooth, showing moderately extensive cystic degeneration, was removed. Pure cultures of streptococcus viridans were obtained from the infected area. Examination of the nose and throat was essentially negative. Skin tests of cultures from the apex of the infected tooth, the naso-pharynx, and the sputum, all yielded positive reactions, that for the culture from the infected tooth having been most severe. A mixed autogenous vaccine was then administered consisting of staphylococci from the sputum (2.5 units), staphylococci from the naso-pharynx (2.5 units), and streptococci (viridans) from the infected tooth (5 units). The patient improved after this course of treatment. Although he has not been entirely cured of all asthmatic symptoms, there has been no return of the severe exacerbations exhibited when he was admitted to the hospital.

That asthma may be aggravated or caused by focal infections has long been recognized. Thomas[6] states that "it is wrong to attempt, by means of vaccine injection, to treat anyone of asthma without first removing all existing focal infections, if possible by surgical means. Surgery alone seldom results in the cure of asthma, but surgery plus vaccine treatment solves many seemingly difficult problems. Some asthmatic patients owe their symptoms not only to inhaled or ingested proteins, but also to bacteria of which they are the host. The basic requirement for a bacteriological investigation of the asthmatic patient is a thorough examination of material from

[6] Thomas, William S.: Asthma; Paul B. Hoeber, Inc., New York, 1928.

all possible foci of infection, with a view to the preparation of vaccine for use in testing and if necessary in treatment. Attention is directed to the study of material from the naso-pharynx and tonsillar crypts, of sputum from the deeper air passage, and of fecal matter. Other possible sites of focal infection should be considered, such as apical tooth abscesses, gall-bladder (duodenal contents) infection, endometrium, seminal vesicles, and urinary tract."

VI. CONCLUSIONS

Focal infections may play an important rôle in the etiology or aggravation of asthma.

Thorough examination for foci of infection should be undertaken in the asthmatic patient, and when feasible discovered foci should be removed, cultures taken, and vaccines prepared for use in skin testing, and, if necessary, in treatment.

Dental infection may constitute an important focus of infection.

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A STUDY OF A PIGMENTED DENTAL PLAQUE

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I. INTRODUCTION

When one bears in mind that muco-bacterial films cover the surfaces of almost all teeth, carious or immune, and that the inception of dental caries takes place on the surface of the enamel, it is obvious that the nature of these films must be an important factor in determining the onset of this disease. It is somewhat surprising that more attention has not been given to the relationship between these conditions, which as yet seems to be but poorly understood. It, therefore, seems worthwhile to report an investigation upon the nature and effect of one definite and easily recognizable type of plaque.

The opinions of previous authors on the effect of deposits of mucin and bacteria are varied. Williams (17), Black (1), and Lohmann (11), believed these films to be detrimental, the last mentioned attributing the harmful effects to the mucin itself. Miller (12a) believed that mucin plaques had no effect. Others again have credited the mucin with protective (15) and buffering (10) properties. Pickerill (14a) and Goadby (5a) drew attention to bacterial deposits on the teeth which were associated with immunity to caries. If we accept Naeslund's (13a) interpretation of the nature of salivary calculus, it might

[1] Rockefeller Fellow in Dentistry.

be included as another instance of this. Hadley (6) has suggested the possibility of colloidal films over the teeth in which undesirable bacteria would be destroyed. It seems, therefore, that the condemnation of all muco-bacterial deposits is unjustifiable without a more definite knowledge of their nature and effects.

Of the various formations on tooth surfaces several are noticeable on account of characteristic pigmentations. The most commonly observed is the green stain on the labial surfaces of a freshly erupted dentition. Less striking, although no less common, is the brown pigmentation which occurs about the gingival third of all teeth in certain mouths. Being of a firm, fixed nature, the word "plaque" is used to distinguish this latter from other looser and softer surface-aggregations and films. A study of this particular plaque forms the subject of this paper.

II. DESCRIPTION OF PLAQUE

This plaque appears on the lower third of the teeth as a brown line, sometimes fine and mottled, at other times strong and bold. In most cases it is separated from the gingival margin by a clear portion of enamel, although it is sometimes so advanced as to occupy the whole of the gingival third of the teeth. In any mouth in which the growth is at all pronounced, it is present in all the pits, fissures and depressions on the occlusal, lingual and buccal surfaces of the teeth. The brown line is most easily observed on the linguoproximal aspects of the posterior teeth, especially the upper premolars and molars; but when it has been observed here, closer examination generally reveals it on the lingual aspect of all the teeth toward the interproximal spaces. It seems to appear as a rule on the portions of the teeth not subjected to the full cleansing action of the process of mastication. Thus it is that it appears in the hollows and fissures on the surface of the teeth, and invariably forms a crescent shaped line just below the greatest diameter where muscle and food friction are at a minimum. That it is so readily observed upon the surface of the premolars may be accounted for by the fact that these teeth are often bell-shaped, and the most bulbous portion thus well separated from the gingival margin. Thus the line that forms below the greatest diameter is readily observed above a space of clear enamel. In other teeth, for instance

the incisors, the line formed below the greatest diameter of the teeth approximates closely to the gingival margin, and is therefore not so strikingly evident. In short, it would seem that the surfaces of the teeth most prone to stagnation offer the most suitable site for the formation of this brown plaque. Variations in the color of the line are noted through all the shades of brown to almost black. I believe that the older the deposit, the darker its color; for, where the line has reappeared shortly after cleaning operations, it always seems of a reddish light-brown color, whereas old deposits always appear dark-brown. The line seldom exceeds more than 1 mm. in width, and is sometimes strikingly regular about the necks of all the teeth on all their surfaces. It appears to be a fine deposited film, never of any appreciable depth, sometimes in sufficiently thick layers to be removed by the use of sharp scaling instruments, but always in too small a quantity to be chipped off like calculus. At first, these pigmentations are easily removed with an engine brush and pumice, but later are firmer and more adherent and best removed by use of scaling instruments. Newly formed deposits cannot be felt with a probe, but older deposits give a somewhat gritty feeling on passing the point across their surfaces.

On account of its localization, its persistence, and reappearance in the mouths of adults, this condition seems in no way to be associated with those pigmentations occurring on freshly erupted teeth which are attributed to impregnations or bacterial decompositions of Nasmyth's membrane. It can be distinguished from the slightly similar tobacco staining by its appearance and distribution, and by its occurrence in the mouths of very young children. The stainings produced by iron and chlorine can be differentiated, the former by its color and less localized nature and the latter by the absence of the causative factor. Food-staining and debris-stagnation produce less uniform and less compact deposits. Staining by blood pigments may be excluded, too, on the ground of an absolutely complete absence of any hemorrhagic tendency associated with this condition. (*Figs. 1* and *2.*)

III. PREVIOUS DESCRIPTIONS OF PLAQUE

So far, although this condition has been noted in dental literature, little effort seems to have been made to determine its significance.

Miller (12b), in 1890, described it accurately, commented upon its persistent nature, and noted its occurrence in members of the same family. Pickerill (14b) described the plaque in detail as "a thin dark brown stained line about the necks of the (immune) teeth. The stain varies from a light to a very dark brown color, and is from 0.5 to 1 mm. in width. It appears in the form of a deposited film of calculus; it is never in so thick a deposit that it can be detected by the naked eye; it may and does occur in any age from infants upwards." His further suggestion that the occurrence of this plaque is associated with immunity to caries originated this work. Bunting (4) described a condition of "black stain" and differentiated it from the "red orange stains" mentioned by Goadby (5b). The condition is apparently identical with that here termed "brown plaques," which latter name seems more accurate, as however close these deposits come to being black they never entirely lose their original brown or red-brown color. It seems probable too that the red and orange forms are variants of the same condition, the color difference depending on age and other factors. Bürger and Grütz (2) described a reddish tenacious deposit found mostly on the labial surface of the gingival third of the teeth. Although this seems a possible variant of the conditions mentioned by Miller (12b), Goadby (5b), and Pickerill (14b), the authors apparently believed it to be quite different. A bacteriological investigation of this condition, while failing to isolate and culture a causal organism, revealed a preponderance of pleomorphic diphtheroid organisms in smears and parallel branched filaments in section examinations. In none of these records does there seem to have been any effort to determine the exact nature, cause, or effect of this brown plaque.

Pickerill (14c) has suggested the possibility that bacilli of the mesenteric group are responsible for this pigmentation, owing to their property of producing red and brown pigments. Goadby (5c) has supported this view in part, and furthermore has pointed out that organisms described as *B. gingivae pyogenes*, *B. prodigiosus*, *B. plexiformis*, and *Micrococcus roseus* (5d), would be capable of producing pigmentation in the mouth. These opinions suggest a bacterial cause, but it is likely that a chain of factors play a part in their formation as is the case with calculus deposition.

IV. EFFECT OF PLAQUE ON TEETH

Pickerill (14b) suggested that this plaque was associated with lessened susceptibility to dental caries, an opinion which to the writer's knowledge is supported by many dentists who have been interested in this condition. Bunting (4) stated the opposite view, and reported its association with rapidly advancing caries and superficial decalcification.

In order to collect some concrete evidence in this connection, a statistical survey of the incidence of caries in a group of 100 mouths

TABLE 1

Incidence of caries in patients having the brown pigmentation ("brown plaques")

GROUP NO.[1]	INITIAL LETTERS OF PATIENTS IN GROUP	NO. OF PATIENTS	TOTAL NO. OF CARIOUS TEETH IN GROUP	AVERAGE NO. OF CARIOUS TEETH
I	A—Ay.	100	912	9.12
II	B—Bo.	100	941	9.41
III	C—Cz.	100	951	9.51
IV	D—Dn.	100	904	9.04
V	E—Fu.	100	943	9.43
VI	G—Gr.	100	862	8.62
VII	H.	100	884	8.84
VIII	I, J, K.	100	838	8.38
IX	L—Lz. and Na.	100	959	9.59
X	M—Mz.	100	850	8.50
Special[2]	Various	100	530	5.30

[1] Groups I–X are control groups (unpigmented teeth).

[2] The "special" group had "brown plaques."

having this pigmentation was undertaken. As a basis for comparison ten control groups (unpigmented) of the same number of patients (10 × 100) were examined, each group having the same number of patients of ages corresponding to those of the special group. Thus each group of 100 patients contained 4 of 4, 1 of 5, 2 of 6, 5 of 7, 6 of 8, 7 of 9, 13 of 10, 13 of 11, 4 of 12, 15 of 13, 11 of 14, 5 of 15, 1 of 16, 4 of 17, 2 of 18, 6 of from 20 to 30, and 1 of from 30 to 40 years of age. These groups were compiled in strictly alphabetical order from the record cards of patients in the Out-Patient Department of the Public Hospital at Christchurch, New Zealand. All filled and extracted teeth, besides those with detectable cavities, were recorded as carious;

both deciduous and permanent teeth were noted in children under the age of 8, whereas above that age only the permanent teeth were taken into account. The findings in the accompanying table show that the variations in the control group are from 8.38 to 9.59 carious teeth per mouth, whereas in the "special" group there are only 5.3 affected teeth in each mouth. The incidence of caries per mouth in the whole 1000 control patients is 9.04, whereas in the "special" group (100) it is only 5.3, a little over a half of the average. From this it may be concluded that there is a lessened incidence of caries associated with this brown plaque. Furthermore, this difference is sufficiently striking to merit a detailed examination of the possible causative factors of this condition.

V. COMPOSITION OF BROWN PLAQUE

A. Physical examination

For examinations of the plaque material, it was obtained from teeth that were isolated with cotton rolls, washed thoroughly with a mucin solvent, such as sodium bicarbonate or magnesium sulphate, to remove all saliva and the superficial part of the plaque material. After treating with absolute alcohol, plaque was removed with scaling instruments into small quantities of distilled water. Material collected in this manner revealed, in stained and also in unstained microscopic examination, little structure except contrasting masses of faintly stained gelatinous substance and amorphous earthy masses. No crystalline formations were detected. Attempts to examine plaque material on the surface of decalcified enamel sections were unsuccessful. In only one or two cases could the deposit be found in the section preparations, and in no case were any details of structure discernible.

B. Chemical examination

Analytical tests were performed on plaque material gathered in the manner described above, the mucin solvent having been omitted, of course, to avoid interference with the tests to be made.

a. Mucin tests. (1) Plaque material was smeared evenly over the surface of a microscope slide, which was then divided by a grease-pencil line. On one side of this line a saturated solution of $NaHCO_3$ was applied for five minutes; the other was treated similarly with dis-

tilled water. Washing and immersion in alcohol at once precipitated the remaining mucin, and removed the pencil mark. Examination of the slide now showed a marked difference in clearness between the two portions, owing to the removal of some soluble substance, evidently mucin. (2) *A slide prepared as above* was focused under a low power of the microscope, and a distinctive part of the field recorded in a rough drawing. Ten percent NaOH solution was run on to the field, which was examined every few minutes over the period of an hour. At the end of this time there was a considerable clearing of the gelatinous portions of the field. Again there was an evident solubility of some constituent substance, probably mucin. (3) *The xanthoproteic test* for proteins gave a slight positive reaction. (4) *Millon's test* was negative, possibly owing to the effect of salts of plaque material, although dilution did not change the result.

b. Calcium test. Scrapings were extracted with hydrochloric acid, neutralized with ammonia, and then acidulated with acetic acid. The addition of ammonium oxalate gave a slight white coloration in every case although no definite precipitate occurred.

c. Magnesium test. Attempts to obtain a precipitate of magnesium triple phosphate from the above (*b*) with ammonia were in all cases unsuccessful.

d. Carbonate tests. (1) In scrapings triturated with distilled water over a long period, and treated with calcium chloride, a definite white coloration resulted. Effervescence with acetic acid could not be determined. (2) Under a low power of the microscope, plaque material was subjected to the action of 10 percent hydrochloric acid, colored to facilitate the observation of bubble formations. Small bubbles formed very slowly on the masses under observation.

e. Phosphates. Nitric acid and heating with ammonium molybdate consistently produced a yellow coloration.

Even though the collected material from several mouths was sometimes used for a single test, the value of these results seems to have been limited by the small existing amounts of the substances for which the tests were made. It is evident, however, that in this plaque there occurs an organic protein element soluble in alkali, evidently a form of mucin, as well as small quantities of calcium carbonates and phosphates.

C. Bacterial examination

To show whether the bacterial constituents of this deposit varied from other similarly located films in the mouth, a series of bacteriological examinations were made. The method adapted was to compare stained smears from identical sites in two patients of the same age, one with and one without the brown plaque on the teeth, both specimens of course being collected after treating the area in the manner outlined above. Material gathered in this way was washed onto a slide with distilled water, and allowed to dry there without smearing. In this manner it was possible to obtain a truer indication of the bacterial disposition of the collected specimen. These slides were stained simultaneously with Gram stain or Loeffler's methylene blue, and the fields compared.

The results of twenty-five examinations of plaque material compared with calculus, "white deposit," and normal film, showed that Gram-positive thread and small Gram-positive bacillary forms were more abundant and regular in appearance, while there was a relative decrease of indeterminate forms. In the six calculus preparations, Gram-positive threads were regularly present, but were slightly larger and less regular in morphology and staining. In the five preparations from the "materia alba," Gram-negative thread forms and bacilli seemed to be more prominent. In the remaining preparations the fields showed the usual variations of mouth smears. The evidence obtained in this manner suggested that the principal bacterial elements in the plaque masses were thread forms showing little branching or club formation, and small Gram-positive bacilli (diphtheroids), and that these elements were much more regularly present than in other deposits and films (excluding calculus) occurring on the surface of the teeth. In fact they were present so regularly as to suggest a causal agency. These findings coincide with those of Bürger and Grütz (2).

VI. FACTORS INFLUENCING PLAQUE FORMATION

A. Bacterial

As the previous considerations have given no indication of an immediate cause of this pigmentation, it was hoped that by isolation of organisms of the thread or bacillary types such a factor would be

found. The more remote causes would then be those which provided a suitable environment, such as diet, mucin precipitation, and the absence from the mouth of overwhelming growths of antagonistic

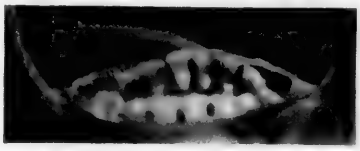

FIG. 1

FIG. 2

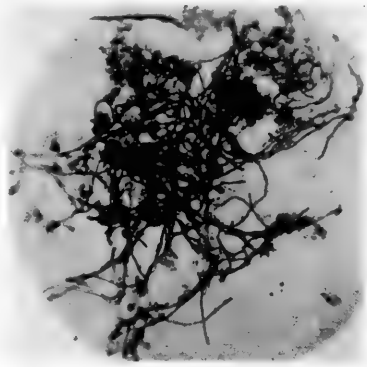

FIG. 3

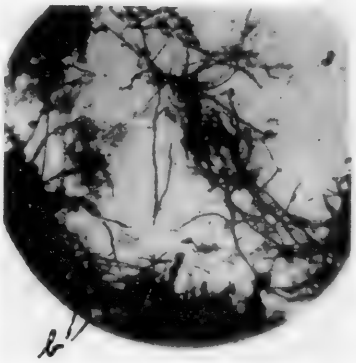

FIG. 4

FIG. 1. SHOWS BROWN PLAQUE ABOUT GINGIVAL MARGIN OF LINGUAL SURFACES OF LOWER INCISORS

FIG. 2. SHOWS PLAQUE ABOUT BUCCAL SURFACES OF POSTERIOR TEETH

Note the separation from the gingival margin on the posterior teeth, and the irregularity of position on the lateral incisor, which is in lingual occlusion.

FIG. 3. SHOWS BACTERIAL THREAD-ELEMENTS IN GRAM-STAINED PREPARATION OF PLAQUE MATERIAL

FIG. 4. SHOWS THREAD ELEMENTS

At "b" threads are shown constituting the bulk of the plaque mass

bacteria. With this object the isolation of any significant forms was attempted. For this purpose plaque material was removed from teeth after the treatment outlined above, with the additional isola-

tion of the field with sterile towels. Removal was accomplished, before the saliva returned to the plaque, after the application of absolute alcohol, and by means of an aseptic Cushing scaler introduced into the culture medium. In twenty-nine cases cultures were taken from identical sites in pigmented and unpigmented mouths, the latter to serve as controls, by the use of which it was hoped that different and distinct organisms could be demonstrated in the test cultures. As smear examinations had shown small numbers of cocci and Gram-negative bacillary forms, these types of organisms were neglected and attention limited to small Gram-positive bacillary and Gram-positive thread-forming organisms. The culture media used included all the common laboratory media, with the addition of the gelatin-stab preparations on which Miller (12c) had successfully cultivated chromogenic forms, potato media according to Goadby (5e), and saliva-agar and saliva-ascitic-agar, as recommended by Naeslund (13b). Both aerobic and anaerobic cultures were made. No controls were used with the last two media, nor in the anaerobic cultivations. A number of inoculations were made into nutrient broth, subculturing only from such tubes as showed thread or bacillary forms in appreciable numbers. A mistake was probably made in disregarding such forms as appeared in both control and test inoculations, as the appearance of a type in a control culture did not necessarily debar it from being causal under different circumstances.

In all, seven thread-forming organisms were isolated. Of these four were anaerobic, but only one was capable of subculture. Of the aerobic forms, two grew readily in subculture; both, highly pleomorphic, appearing in subcultures as branching threads, sometimes with sheath formation and bacterial fragmentation, and again as regular bacilli. From their growth-reactions, it was impossible to identify these types as any of the recognized oral microörganisms. Morphologically one type resembled the Leptothrix buccalis described by Bulleid (3), although culturally it was rather dissimilar. The second type was more comparable to the Bacillus buccalis maximus of Goadby (5f) and Miller (12d), or to the Leptothrix gigantea of the latter author (12e), than to any other organism, but here again there were cultural discrepancies. The first type showed a slight yellow chromogenic tendency on agar. The latter formed an adherent growth in

liquid media, suggesting the possibility of plaque formation on smooth surfaces. Both forms showed proteolytic properties indicating that the proteins of the saliva could be used, and life supported in clean mouths. Beyond this, however, there is no indication that these isolated and cultivable organisms are causal of the brown plaque, especially as these forms were isolated in only two of the many cultural endeavors.

A further incomplete description of these forms seems of no value, as it would do nothing to dispel the fog which enshrouds the peculiar thread-forming organisms of the mouth. These forms appear to be associated with all film formations, and yet it is impossible to classify them in the least degree, or even to place them definitely in the bacilli, actinomyces, or possibly non-existent leptothrix group.

B. Oral hygiene

It has been shown that there is a definite relationship between a reduction in the incidence of caries and the existence of this plaque. It seems possible, therefore, that the occurrence of this latter condition may be dependent upon a healthy state of the tissues in the mouth. To elucidate the question, the following observations were made.

a. Effect of caries. In an examination of the histories of more than 100 patients showing this condition, it was found that in 30 cases the teeth had at one time been very carious, but that since the completion of the first treatment the progress of destruction had practically ceased, even through the most susceptible years. In several cases, the patient volunteered the information that the "brown line" had been present "since the bad teeth were extracted." Other cases were noted in which the plaque was present in one member of a family, while the others who enjoyed similar food and environment showed no signs of the condition. In all cases the mouths with the plaque were the less carious. One case was observed in which three weeks after the completion of fillings in eight teeth, the brown line appeared. Unfortunately, a coincident change of diet prevented the drawing of conclusions.

In an attempt to gain definite information in this connection, three cases were chosen in which considerable caries was present as well as traces of the brown plaque. Record of the extent of the latter was

made by listing exactly the teeth bearing the plaque, with rough drawings of its nature and distribution. The mouths were then rendered healthy by fillings and extractions, and reëxaminations made from time to time. In one case the line was absent after eight months, perhaps owing to improved prophylaxis; in one case there was no apparent change; in the remaining case the line became more pronounced and darker. It seems that the occurrence of this line may be assisted by the removal of carious teeth.

b. Effect of pathological conditions of soft tissues. Several cases were observed in which the brown plaque was present in mouths showing pathological lesions. In one case a generalized gingivitis accompanied a strong pigmentation. In two cases a gingivitis and a buccal infection occurred on one side of the mouth while plaque formations were present only on the opposite side. On two occasions full jaw extractions were necessary, once from the upper and once from the lower jaw. In both cases the teeth of the other jaw, which showed a marked pigmentation about the gingival margins, remained healthy. It seems that certain pathological conditions are inhibitory to plaque formation, but that others do not have that effect.

c. Effect of prophylaxis. A general survey of the hygiene of these pigmented mouths showed that as a whole, in spite of the decreased amount of caries, these mouths were less carefully cared for than the average. An examination of the tooth-cleaning habits revealed that, of 100 patients,

15 cleaned their teeth more than once daily.

47 cleaned their teeth once daily.

14 cleaned their teeth less than once daily.

24 never cleaned their teeth.

Of those who cleaned their teeth once daily, by far the greater number performed their daily task before breakfast, so that for all practical purposes these mouths might be regarded as uncleaned. In fact the 15 patients who cleaned their teeth more than once daily were the only ones who could be credited with having anything like clean mouths. That it is impossible to point to any particular habit of dental care, as a definite adjuvant to this plaque formation, will be better realized when the diversity of dentifrices used, and the differences in the manner of cleaning employed, by each patient is borne in mind. Each person it seems has his own particular technique for tooth

cleaning, by which in most cases certain parts of the teeth are not touched by the brush. In fact it is not uncommon to find large areas of the mouth quite neglected, and it was seldom in the children who came under the writer's care that such an area could not be found. Although proprietary preparations were most popular, the types of dentrifrice used were legion and included all possible substitutes such as soot or "bon ami."

Certain conditions were observed, however, which suggest that dental prophylaxis can be an important factor: (1) the plaque formation was more obvious in the less-cleaned mouths, and in such as had a definite mucous film on the surfaces of the teeth. In such mouths it was not uncommon to see a hard almost black plaque covering a major part of the lower third of the teeth. (2) In well-cleaned mouths, and where there was little sign of a mucous film upon the teeth, the pigmentation was much less marked; and here was seen only in the interproximal spaces, and as a fine line about the lower third of the teeth. It seems that the growth can be kept off the accessible surfaces of the teeth by assiduous brushing. This probably accounts in no small measure for the fact that the line is so frequently seen upon the lingual surfaces of the lower incisors and upper premolars, both sites in which careful brushing is easily omitted. Suggestive of this was the case of a brother and sister of nearly the same age, showing the same degree of pigmentation in inaccessible sites. In the accessible localities, the care of the feminine toilet kept the teeth free, while even the labial surfaces of the brother's teeth were heavily pigmented. In another similar case of two sisters, the younger complained that "it took too much brushing to keep the stain away." Other cases showed heavy deposits on individual teeth neglected by imperfect brushing. There were also cases where the patients had despaired of keeping the pigmentation away by the use of a brush.

Interesting observations were made at the Canterbury Fresh Air Home for suspected tubercular children, where an acid mouthwash is used according to Pickerill's (14d) recommendation. Here the occurrence of the plaque is very common. A similar relationship between the use of this mouthwash and the increased incidence of the pigmentation was reported from schools in the Wanganui district, New Zealand, where the institution of its daily use was followed by the appearance

of the plaque in many mouths. It has been noted that in cases where bicarbonate of soda has been used as a dentrifrice, the teeth were particularly clear of all films and deposits. In one of these cases, however, a heavy deposit of brown pigment was observed about a few teeth, which it was found were completely neglected in the cleaning procedures.

To test the influence of the use of certain substances several experiments were performed. (1) A girl of 10 years gave a history of appearance of the brown line after she ceased the use of hydrogen peroxide as a mouthwash. The plaque was removed from the surfaces of her teeth except those of the upper left side. Full strength H_2O_2 was used twice daily on a brush. After four months the pigmentation had not reappeared on the cleaned teeth. Three weeks after cessation of the treatment the stain had returned about all the cleaned surfaces. (2) In another mouth the pigmented lower canines were cleaned and washed daily with pledgets of cotton wool. For one, saturated sodium chloride solution was used; for the other, saturated sodium bicarbonate solution. It was found that after ten days the canine treated with the latter had lost all its plaque, while the other remained almost unchanged despite exactly the same number of rubbings with the sodium chloride solution. (3) After cleaning the lower anterior teeth the plaque was found to reappear on two unwashed ones, previous to its appearance on the two adjacent ones which had been subjected to daily treatment with distilled water. Other adjacent teeth washed with sodium chloride and sodium bicarbonate solutions gave no signs of its reappearance, after a period of three weeks.

It seems that the brown pigmentation can be kept from the surface of the teeth by assiduous brushings. It appears that strong antiseptics and mucin solvents assist in keeping this plaque from the surfaces of the teeth, whereas there are indications that a slightly acid dentifrice stimulates the formation of this plaque. A certain degree of uncleanliness does not appear to inhibit this condition.

C. Diet

Miller (12b), in 1890, noted the occurrence of this brown plaque in five members of the same family. The writer has on twenty occasions observed the condition in several members of the same family. In

the examination of children from orphanages and similar institutions, a large percentage of occurrence was generally noted. In the examination of ten four-year-old girls from one home, every one was found to show pigmentation (associated incidentally with complete immunity to caries in every case). Older children from the same institution also showed a high percentage of occurrence. In the Institute for the Deaf, of forty old residents the condition showed itself in ten mouths; of thirty-four new arrivals, none gave evidence of it. In considering this increased incidence in these groups we can immediately rule out the "hereditary constitutional factor" suggested by Miller. Thus the only common factor remaining seems to be the diet.

In all cases where this plaque was observed, inquiries were made of the patient or parent to ascertain the nature of the food consumed. As exact information was available from the institutions, it was possible to compare the diets of these individuals and groups with the average diet. The findings were briefly as follows. The patients of the whole group were of the poorer class, and the food of a plainer and less varied nature than that to which others are accustomed. It included much less of the rich carbohydrate foods such as cakes, cookies, biscuits, and fancy desserts. These were replaced by a larger vegetable and fruit consumption. There was little or no food eaten between meals. Milk was commonly used in fair amounts. Only three in the whole group laid any claim to the consumption of sweets or candy.

It seems that a low carbohydrate diet is associated with the formation of this brown plaque. This may have effect through a change in the oral flora, as suggested by Goadby (5a), and Howitt, Fleming and Simonton (8), or in the nature of the saliva itself, or in the factors influencing the precipitation of the salivary proteins.

D. Saliva

Analytical examinations of the saliva were not possible in this work, but note was taken of its clinical appearance in all of approximately 160 cases. With one exception, and possibly owing to reflex influence, the saliva was present in normal amounts, and was normal in viscosity. Calculus was associated with 8 per cent of these plaque formations, generally on separate teeth. It may therefore be concluded that the

salivary changes associated with the deposition of calculus are unimportant in the causation of the other condition.

Hypothetically, the precipitation of the proteins of the saliva would be important in the origination of any deposit on the teeth. Mucin and globulin (7) precipitation in a pure state by acids (9) or water could form a nutritive medium for proteolytic and chromogenic bacteria (12f, 14e, 16). These precipitations would be moved by food and muscle action into stagnating areas of the mouth, pits, fissures, interproximal spaces, or the gingivae, where fresh mucin is being secreted continually. In these sites bacterial growth would continue, with a preponderance of the proteolytic forms, provided carbohydrates did not become impregnated into these deposits. Evidence that such a sequence actually does occur is furnished by the occurrence of the pigmented plaque about teeth in cases where the use of an acid mucin-precipitating mouthwash has been commenced, and the absence and easy removal of the pigmentation under the influence of mucin-solvent alkali-dentrifrices. Furthermore, the irregular distribution about maloccluded teeth, and in one case where the muscle tonus of the lips was lost, indicates that muscle action is a factor in localizing this pigmentation.

VII. SUMMARY AND DISCUSSION

It seems that the nature of this brown pigmented plaque is somewhat similar to that of salivary calculus, both in its physical nature and its chemical components. In it are present small quantities of inorganic substances, possibly in the form of calcium and magnesium phosphates and carbonates, as well as quantities of mucin or its compounds, which have been precipitated from the saliva. Another point of similarity with salivary calculus is that both substances appear in conjunction with large numbers of bacterial thread-forms, and it is suggested that these thread forms are an important factor in the formation of the plaque.

When this condition is established about the teeth, it appears to have the reverse of a harmful effect upon the teeth themselves. The incidence of caries in 100 cases having brown plaques was little over one-half of the average in 1000 patients of corresponding ages, attending the same clinic, but having no brown plaques.

It is suggested that the occurrence of these pigmentations depends upon a certain chain of factors. Mucin is precipitated upon the teeth in a pure state by acids in food or dentifrice. If this precipitate is undisturbed, and uncontaminated by carbohydrates, it is gradually moved by muscle action to the sheltered areas on the teeth where, dependent upon the health of the mouth and consequent type of the oral flora, certain bacterial forms become established. The most common of these seem to be thread forms of the actinomyces group, a number of which were isolated but not classified. These forms probably fix deposits of inorganic salts upon the teeth as is the case with the actinomyces of calculus. Although many members of the actinomyces group produce pigment, none of the forms from the plaque produced brown pigment in culture. Such pigmentation has been observed, however, in a form isolated from calculus. The manner in which the pigmentation appears, first as a light reddish coloration developing to a dark brown, is suggestive of certain of the chromobacteria or mesenteric bacilli, but there was little evidence of such forms in smear examinations.

It is thought that the lowered incidence of caries is principally the result of superior food habits in the special group of patients, although the existence of strong colonies of benign bacteria in otherwise susceptible sites no doubt exerts a defensive action.

The principal value of this discussion seems to be its suggestion that a sweeping condemnation of all deposits on the surface of the teeth is unjustified, as at least this particular plaque appears to exert nothing but a protective action.

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HISTOLOGIC CHANGES IN THE RAT INCISOR FOLLOWING HYPOPHYSECTOMY[1]

A Preliminary Report

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This study is based on twenty-three successfully hypophysectomized rats. Their ages when operated upon ranged from 36 to 64 days. The interval between the operation and the death of the animal ranged from 63 to 459 days. This gave a sufficiently complete series of stages so that the regressive changes could be followed. The operations were performed by the parapharyngeal approach, following the technique of Prof. Philip E. Smith. An operation was considered successful when there was no increase in spontaneous growth for months, and no spontaneous oestrous cycle for weeks or months.

A study was also made of sixteen litter-mate controls, most of which were unsuccessfully hypophysectomized. The latter, as well as the unoperated litter-mate controls, showed no indication of hypophyseal deficiency. The gross findings were (*a*) progressive retardation and final cessation of eruption; (*b*) distortion of form, especially in the basal zone. (*c*) Smaller size of teeth (two-thirds normal size). The histologic findings are summarized below.

1. The enamel epithelium undergoes regressive changes and foldings, which result either in vicarious, aborted, enamel-formation in the labial periosteum, or in hypoplastic areas of enamel. The ganoblasts become cuboidal and flat, and finally degenerate. The papillae become irregular, proliferate into the labial alveolar periosteum where they become isolated in the form of epithelial islands, and

[1] Read at a meeting of the Chicago Section of the International Association for Dental Research, Medical and Dental Arts Club, October 9, 1931. This investigation was in part supported by the John D. Hertz Fund of the University of Chicago.

finally undergo degenerative changes. In the anterior zone,[2] in animals that lived more than ten months after the operation, the enamel epithelium is entirely lacking.

FIG. 1. A mid-sagittal section of the upper right incisor of Rat 216, which was hypophysectomized when thirty-nine days old and lived 372 days after the operation. ×10½

2. The enamel in the anterior zone is normal except for occasional hypoplastic areas that are usually associated with connective-tissue

[2] The term "anterior zone" refers to the anterior eight or nine tenths of the tooth. The "basal zone" contains the base of the pulp, and is the seat of activity of Hertwig's sheath.

ingrowths. In the basal zone the enamel shows many variations from normal structure to complete absence.

3. The dentin in the anterior zone fills the pulp almost entirely so that the tooth contains practically as much dentin as does the normal control, although the bulk of the tooth is one-third smaller than the normal. The structure in this zone is normal except for some pulpal inclusions. At the basal zone the dentin forms the principal bulk of the multiple foldings, and varies structurally from normally calcified to very poorly calcified dentin and irregular uncalcified matrix.

4. The pulp is almost completely obliterated and dentified in the anterior zone. The pulpal slit that remains in this zone contains many calcified globules. In the basal zone the pulp takes on a more or less typical appearance, but its blood supply is reduced in comparison with the rich blood-supply of the control material.

5. The cementum is thicker than normal. It sometimes reaches five times the normal thickness. Its outline is sometimes disturbed in the basal zone.

6. The periodontal membrane is, as a rule, normal in structure, but its blood supply is below normal. It is uneven in width, and contains an increased number of epithelial rests.

7. The labial alveolar periosteum has a reduced blood supply and is irregular in width. Occasionally it contains islands of bone that are near the enamel, or in contact with the enamel.

8. Hertwig's sheath displays greater vitality than any other dental tissue. It is often displaced. An accumulation of eosin-staining fluid between the sheath and the pulp is sometimes observed.

The actual conditions in a given case naturally depend on the time elapsing between the operation and the death of the animal, and are progressive.

AN UNIDENTIFIED ORGANISM EXHIBITING CULTURAL CHARACTERISTICS SIMILAR TO THOSE OF THE BACILLUS FUSIFORMIS

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I. INTRODUCTION

While trying to obtain the Bacillus fusiformis in pure cultures from cases of trench mouth we isolated another organism which, we believe, belongs to the same biological class. Cultural studies indicated that both organisms have a complex life-cycle. Investigators have had different opinions on the morphology and the cultural characteristics of the Bacillus fusiformis, but many reports refer to similarities, such as the lack of uniformity in the morphology of the bacillus, its almost constant association with cocci, the presence of long filamentous threads, and the asymmetrical, tenacious, granular nature of the colonies. The organism described in the present paper exhibited similar characteristics in its cultural reactions.

II. REVIEW OF THE LITERATURE

A review of the literature revealed no reference to any colony, growing in semi-solid agar, exactly like the one we shall discuss. Various descriptions of the colony of Bacillus fusiformis have been recorded. In a few, growth in the depths of agar is recorded. Krumwiede and Pratt[1] described a colony, grown in the depths of agar, characterized

[1] Krumwiede and Pratt: *Journal of Infectious Diseases*, 1913, xiii, p. 438.

by thread-like protrusions from one or both sides. Pratt[2] grew the colonies in the depths of agar, getting a flat, irregular mass with a tuft near the center. Occasionally there were wedge-shaped ones with the tuft sticking out at one side. Kast[3] observed colonies, in micro-slide preparations in agar, in which the organisms grew in filaments from a central area. Surface colonies were described by others. Tunnicliff[4] said that the colonies on blood-agar were smooth, moist, and regular; in ascites shake-agar cultures, they were lenticular, with even borders and a slightly brownish tinge. She also described a filamentous thread and threads made up of bacilli. Mellon[5] described his surface colonies as raised, moderately moist, and fairly adherent. Varney[6] classified the organisms into four groups, the surface colony-formation being one means of differentiating the types. They were all granular and adherent, but different in the character of the edges. He also described a tangled, twisted, filamentous, or thread-like organism with granules. Rosenow and Tunnicliff[7] did not describe colonies, but found long filaments and threads with swollen cocci at the ends. Others have described the colonies as small, irregular, felted, brush-like, and hazy.

III. DESCRIPTION

In our cultural procedures, a loopful of exudate from a case of trench mouth was transferred immediately to a deep tube of fresh veal-infusion broth, without dextrose, over brain, adjusted to a pH of 7.4, and incubated at 37°C. for forty-eight to seventy-two hours in a phosphorus jar. Smears were then made and stained by various methods: Gram, Giemsa, gentian violet, and carbol fuchsin. We consistently obtained Gram-negative bacilli of varying morphology mixed with amphoteric cocci and Gram-negative filaments. A series of ten dilutions was made from these cultures; and agar, containing either ascitic fluid or blood serum and adjusted to pH 7.4., was inocu-

[2] Pratt: *Journal of Infectious Diseases*, 1927, xli, p. 461.
[3] Kast: *Journal of Laboratory and Clinical Medicine*, 1928, xiv, p. 112.
[4] Tunnicliff: *Journal of Infectious Diseases*, 1923, xxxiii, p. 147.
[5] Mellon: *Journal of Bacteriology*, 1926, xii, p. 279.
[6] Varney: *Ibid.*, 1927, xiii, p. 275.
[7] Rosenow and Tunnicliff: *Journal of Infectious Diseases*, 1912, x, p. 1.

lated with each dilution and plated out into Petri dishes. The plates, inverted by the method of Krumwiede and Pratt[8] and sealed with a mixture of paraffin and vaseline, were incubated at 37°C. for forty-eight to seventy-two hours, then examined. Of various types of colonies obtained, those yielding the unidentified organism were small, irregular, with indefinite borders and one fringed edge. This type of colony was more abundant and more typical in the lower dilutions that had been plated; occasionally it was found in the control plates. It was very irregular in size as well as in shape, ranging from those visible only under the microscope to those 0.3 mm. to 1 mm. in diameter. The shapes, unlike anything hitherto described, were ovals with filaments on one side; rectangles with one frayed edge; wedge-shapes with a fringe at the apex (like that shown in *fig. 1*); S-shapes; long and thin, short and blunt types, each with a comet-like trail of fine whiskers, hence the appellation "bearded colony."

The general structure of the colonies was the same regardless of the shape, those visible to the naked eye resembling a bit of cotton fiber with one very rough edge. Studied under the 16-mm. objective they presented a granular appearance, with an interlacing of filamentous threads that extended beyond the granules on one side. Three extremities were usually smooth, while the fourth was composed of the threads. The granules were thinner at the edges with a gradual piling up toward the center. Little further detail could be discerned with the high-power objective. A plate was forced open and one colony, transferred immediately to a veal-infusion brain-broth tube, was grown under the same conditions as the original culture. The growth after seventy-two hours was more or less stringy looking. There was no disagreeable odor and no pigment production. In smears, made and stained by the usual methods, there were small amphoteric cocci; large Gram-negative cocci and filamentous threads; Gram-negative, thick, pointed bacilli, and blunt bacilli with granules. By Giemsa's method the cocci were blue and pink; the filaments, blue; the larger cocci, pink; the bacilli, blue with pink granules.

Other colonies, located by means of the microscope, were "fished" from the agar with a sterile dissecting needle. They were placed on a

[8] Krumwiede and Pratt: *Journal of Infectious Diseases*, 1913, xii, p. 199.

slide where they exhibited another marked characteristic: instead of smearing out on a slide like any other colony they remained completely intact, even under pressure. They felt very gritty under the needle point. The entire growth, separated from the agar clinging to it, was dissected under the microscope with two very fine needles (*fig. 2*). When torn to pieces it was fixed and stained by the same methods as slide preparations of cultures. The filaments, cocci, bacilli, and part of the main body were not stained (Gram). With Giemsa's method the filaments and large cocci were stained blue, the cocci pink, and the bacilli blue with pink granules. The microdissected specimen, *fig. 2*, viewed under the oil immersion lens, made a very interesting study. A thick central area, which it had been impossible to tear apart, was composed of a mass of large coccoid forms. Near the edges, and in the thinner portions of the slide, these forms presented smaller ovals, usually four (*fig. 7*). Scattered near the edges were clusters of large and small cocci (*figs. 3, 4,* and *5*), and blunt bacilli having granules that resembled fusiform bacilli (*figs. 9* and *10*). Woven in and out among the granules in the thicker parts, and straggling off to the sides, were filaments of various diameters (*figs. 3* and *4*), each with a central axis, which was sometimes very narrow or wide, and sometimes in one long thread or in nodes. The bacilli were often found in clusters, the organisms pointing to a common center. There was an occasional large coccoid form with a fiber attached to it (*fig. 6*). The large ovals with a light central area and a cart-wheel arrangement of fibrils were very interesting (*fig. 8*). A few of these forms seemed to have broken open and left the fibers exposed. All the cocci, large ovals, and bacilli, seemed to be lying in a matrix of a lighter-staining material.

We repeatedly obtained the same results, the colonies growing more profusely in the media inoculated with a culture than in the controls. They grew in semi-solid agar plates, and in agar-shake tubes, but never on the surface. The growth in agar-shake tubes rarely ever came within an inch of the surface of the media. They were very much like the colonies grown in the agar plates. Further studies of the cultural characteristics and the pathogenicity of the organism are in progress.

FIG. 1

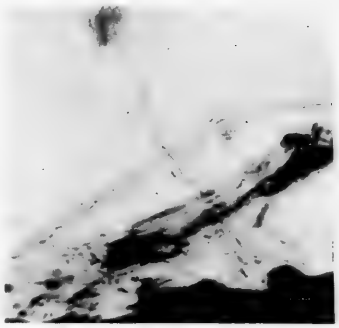

FIG. 3

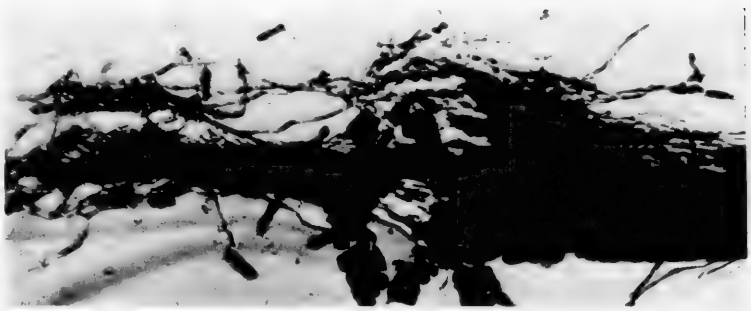

FIG. 2

FIG. 1. Wedge-shaped "bearded colony" in semi-solid agar from culture of exudate. ×35

FIG. 2. Micro-dissected "bearded colony." Giemsa's stain. ×345

FIG. 3. Two groups of small spores and fibers. ×760

IV. DISCUSSION

From the foregoing observations we endeavored to work out the life-cycle, as we see it, of the organism that produces the "bearded colony." It does not exactly correspond to the life-cycle of the Bacillus fusiformis, as we have described it in another paper,[9] but its

[9] Dean and Dean: *Journal of Dental Research*, 1931, xi, p. 759.

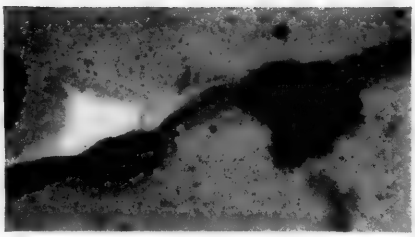

FIG. 4

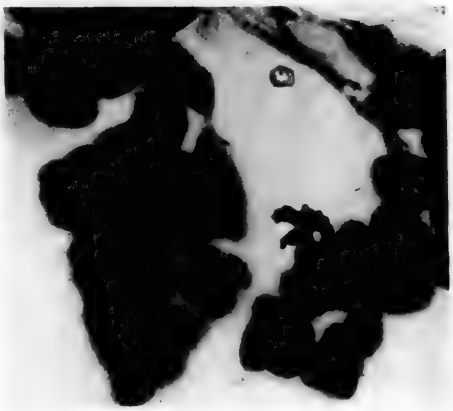

FIG. 7

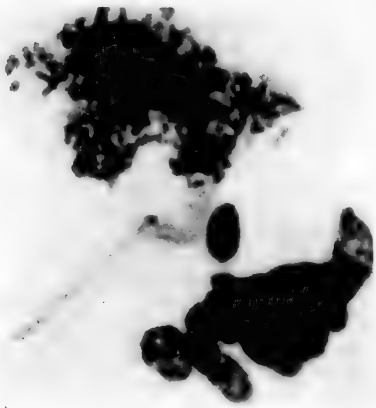

FIG. 5

FIG. 8

FIG. 9

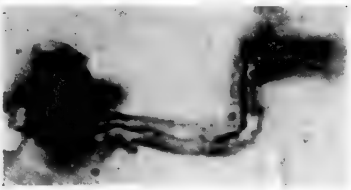

FIG. 6

FIG. 10

FIG. 4. Same as *fig. 3.* ×1425

FIG. 5. Large cocci, swollen spores, large ovals, one fiber. ×760

FIG. 6. Swollen spore sending out fiber, with central axis. ×1425

FIG. 7. Large oval forms, some breaking up into fours. ×760

FIG. 8. Bacilli in cart-wheel arrangement. ×760

FIG. 9. Cluster of bacilli. ×760

FIG. 10. Cluster of bacilli. ×1425

striking similarities lead us to believe that it belongs to the same biological class – a higher order than that of a simple bacterium.

From the photomicrographs (*figs. 1* through *10*, representing the various fields in *fig. 2*, the stained micro-dissected preparation) we made the composite drawing (*fig. 11*) in which it is thought the life-

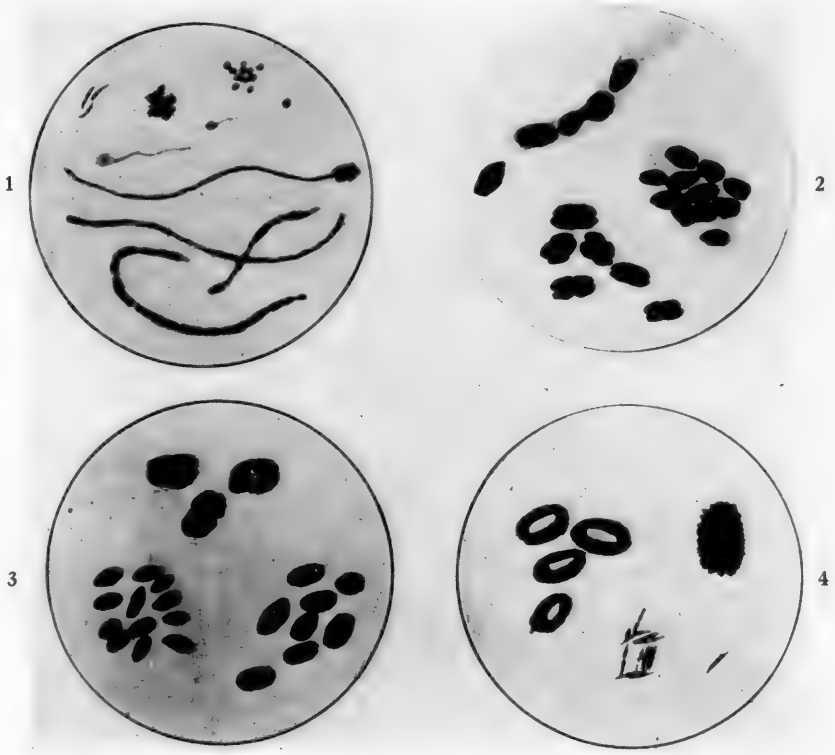

FIG. 11. Composite drawing of life-cycle of bacillus of "bearded colony"

cycle of this organism can be traced as follows: the cycle begins in a very small spore (*fig. 11*, circle 1), hitherto called a small coccus. Under the proper conditions, and at the optimum temperature, the protoplasm of the spore begins to swell and undergo certain changes, until it assumes the form of a large coccus (*fig. 11*, circle 1). A

finger-like projection from one side of the large coccus grows until it forms a filament or mycelium with a central axis (*fig. 11*, circle 1). The coccus clings to the filament until it degenerates or is absorbed. The central axis develops in width as well as in length and, having reached a certain stage of development, breaks up into nodes (*fig. 11*, circle 1). These nodes swell until they almost fill the surrounding sheath, forming a chain of large oval forms, which break from the surrounding medium, piling up in masses (*fig. 11*, circle 2). The remains of the sheath probably form the matrix. The ovals swell and gradually break up into groups of four (*fig. 11*, circle 2), which in turn are released. Each of the four undergoes a series of changes, and the protoplasm assumes a fibrillar arrangement around a clear central zone, with the fibrils pointing to the clear area (*fig. 11*, circles 3 and 4). This gives a wheel-like appearance. The spokes of the wheel develop into the bacilli, which are held in place until they are fully mature. The surrounding sheath or ascus falls away and, if the organisms are not disturbed, they remain in the cockle-bur arrangement that is often seen (*fig. 11*, circle 4). The same bacilli when fully developed contain granules, which are probably the spores. When the bacilli disintegrate they leave these granules or spores in masses, which probably are the reproductive elements and capable of repeating the cycle.

V. CONCLUSIONS

Cultural observations of the organism described in this paper indicate that it goes through a complex life-cycle, which would place it in a higher class than that of a simple bacterium, which reproduces by simple fission.

The general characteristics of the cycle of this organism are so much like those of the Bacillus fusiformis that we believe it belongs in the same class.

The spores may be air-borne and so widely disseminated that they become a contaminating agent, being found in dry agar, and other dehydrated materials.

DESCRIPTION OF THREE INSTRUMENTS FOR USE IN ORTHODONTIC AND CEPHALOMETRIC INVESTIGATIONS, WITH SOME REMARKS ON MAP CONSTRUCTION[1]

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I. INTRODUCTION

The instruments described in this paper were devised in order to facilitate physically accurate projection, upon a plane surface, of measurements taken directly upon the head. They were constructed in response to the long-felt need, arising out of our work on the growing child, in the Child Research Division of the College of Dentistry of New York University, for a satisfactory means of measuring and studying the correctly oriented palate with its denture in relation to the associated structures of the skull, with particular reference to changes of form due to normal or abnormal processes of growth. With the development of our work, the necessity for some definite measure of the changes that were being produced by purely orthodontic means became increasingly apparent. It was desired, for example, to discover what movements of the teeth had been effected as a result of orthodontic treatment, and particularly whether there had been any distal movements of the molars; whether too, as a result of widening the alveolar arch, any calculable changes in the elevation of the palate

[1] The first author is responsible for the innovation of the instruments, the second for their physical elaboration, and the last for their description and the writing of this paper. The authors are conjointly responsible for such views as are expressed in the paper.

[2] Described at the Ninth General Meeting of the International Association for Dental Research, Memphis, Tenn., March 21–22, 1931; *Journal of Dental Research*, 1931, xi, p. 494. See also *Ibid.*, p. 638.

had taken place. It was also desired to determine the exact nature of the changes in the vertical elevation of the individual teeth in response to treatment for the correction of vertical overbite. Thus it came about that our instruments were further elaborated to meet the more purely orthodontic demands.

It will be readily recognized that the rapidly growing science of orthodontia has long stood in need of some simple and reliable means of measuring such changes in the growth of the teeth and palate as those above referred to. It is clear that the description, in terms of physical measurement, of such changes would provide the investigator with an infinitely more accurate and satisfactory record than could ever be obtained by the more usual metaphysics of the preconditioned subjective judgment. The instruments here described are calculated to assist the investigator in measuring the changes in space of the denture and its associated structures, and to give a precise and accurate description of the physical changes that have taken place as the result of orthodontic treatment or normal growth. But it need hardly be said that although the highest degree of probability will obtain for the accuracy of the measures of the structures examined, such a high degree of probability will not necessarily characterise the conclusions drawn from them, for the final interpretation of our measurements will ultimately depend to the greatest extent upon the particular kind of theory we happen to hold. Instruments, it should be remembered, are merely the tools we have perforce to use in order to aid our poorly developed senses the more accurately to perceive part of the nature and some of the relations of things. It is by experiment that we attempt to generate causes which result in instrumentally measurable effects. In orthodontic work, which is based primarily upon the results of individual experiment, we can, most of the time, measure primary causes, although often we can measure also the secondary as well as the primary effects. Secondary and tertiary causes, which may or may not be causes of association or accident, cannot be measured by instruments. Such ancillary causes must, of course, always be taken into consideration in making the final evaluation of physical data, and the discovery of these must be made by appropriate means.

For the rest, the following remarks aim merely at giving an adequate description of the instruments and the method of using them. It will

remain for a later series of studies to present a detailed account of the results obtained by their employment.

II. CEPHALOMETER

The cephalometer is a light instrument weighing some $7\frac{1}{2}$ ounces, and when folded occupies an area of 9 x 11 x 4 inches. It is constructed almost entirely of aluminium. Weighing, as it does, no more than the ordinary hand calipers or compass in common use among anthropologists, it may easily and comfortably be handled by the investigator without either tiring him or placing a burdensome weight upon the subject. The function of the cephalometer is to make such readings upon the head and any of its peripheral structures, in any plane and at any points whatsoever, as the subsequent projection of which (by means of the *plotter* to be described) upon a plane surface will reproduce in all dimensions and as exactly as possible; yielding thus as complete a representation of the structure or structures examined as may be desired. Whilst the cephalometer was primarily designed for the mensuration of the living head, it may none the less readily be used upon the dried skull; and may with advantage be substituted for the comparatively clumsy and more expensive craniometers at present in use. The advantages which this instrument possesses for the worker in the field are obvious, and require no elaboration.

Fig. 1 shows the cephalometer with the attachable impression-tray, *A*, locked in place upon the universal jointed tray-bar, *B*, by means of the screw, *C*, after the impression of the lower denture has been taken. The tray-bar is attached to a universal joint, which is firmly fixed upon the middle of the moveable polar-arm, *D*, and controlled by the screw, *E*. At the pole, *F*, the right-angular arm, *G*, is medially fixed to the center of a large protractor, *H*, which moves absolutely only with the polar arm, *D G*. Lateral to, and at the center of, the large protractor, at the pole, *F*, the freely moving radial arm, *I*, is attached. This arm is independent and does not control the movements of the large protractor, but every movement of this arm may be read upon the large protractor, relative to which it moves, by means of a Vernier scale, which is fixed to the radial arm at *J*. Freely attached to the left (*K*), and right (*I*), radial arms is the elevation bar, *L*. The four

equilateral sides of this bar are calibrated to read to 200 mm., although the total length of the bar without the finger control, *M*, is 238 mm. To the elevation-bar, at *N*, a small protractor is affixed; in this case,

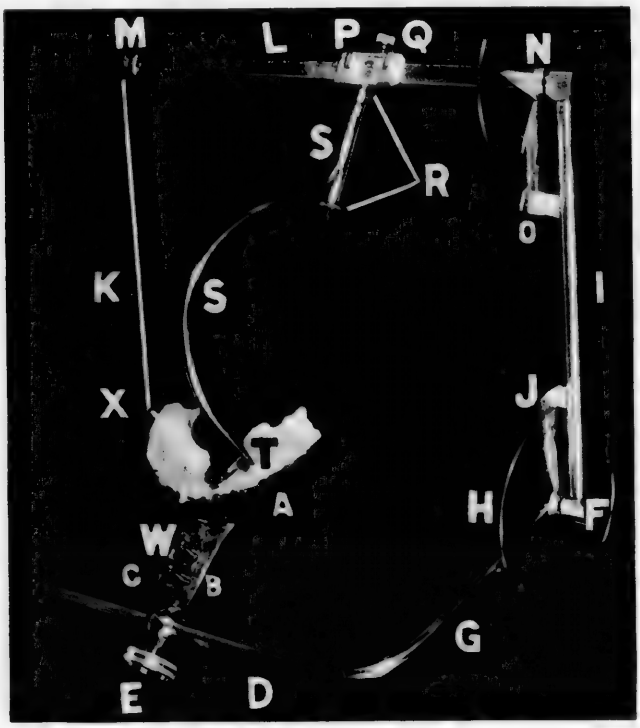

FIG. 1. CEPHALOMETER

A, impression tray. *B*, tray-bar. *C*, tray-bar lock-screw. *D*, anterior polar-arm. *E*, joint-bar lock-screw. *F*, right pole. *G*, right-angular arm. *H*, large protractor. *I*, right radial-arm. *J*, vernier scale of large protractor. *K*, left radial-arm. *L*, elevation bar. *M*, finger control. *N*, small protractor. *O*, vernier. *Q*, surveyor screw. *R*, perpendicular bar. *S*, surveyor body. *T*, surveyor point. *W*, attachment screws. *X*, left pole.

too, the right radial arm has no control upon the protractor's movements, although the radial movements may be determined by a reading of the Vernier scale, which is attached to the arm at *O*. Attached to the elevation bar is a freely moving survey reader, *P*, which may be

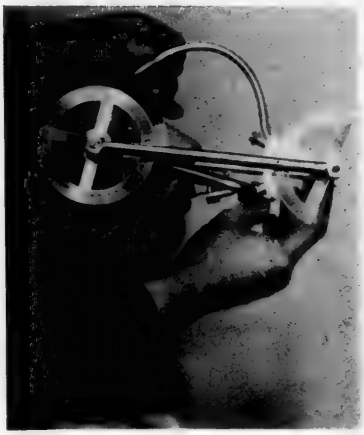

FIG. 2

FIG. 3

FIG. 2. LATERAL VIEW, SHOWING CEPHALOMETER IN USE UPON LIVING HEAD

The impression-tray is fixed within the mouth relative to the axis of the poria, the whole instrument measuring relative to this axis. A frontal measurement is being recorded.

FIG. 3. LATERAL VIEW OF CEPHALOMETER

The cephalometer making a posterior cephalic reading

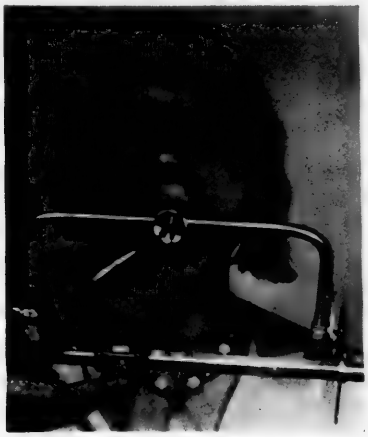

FIG. 4. FRONTAL VIEW OF CEPHALOMETER

The cephalometer making a mandibular reading

fixed at any point upon the bar by means of the screw, *Q*. From the inferior surface of the surveyor there depends, for some 45 mm., a fixed perpendicular bar, *R*, over which the freely moving body of the surveyor, *S*, is attached. The surveyor-point, *T*, remains always and consistently 7 inches distant from the central axis of the elevation bar, no matter where the surveyor may be situated upon the latter.

With the subject comfortably seated in a chair, the independent impression tray, *fig. 2*, together with the impression material, is introduced into the mouth, and the plaster allowed to set upon the upper or lower denture. It is customary to take the cast of the upper denture first, and the cast of the lower denture, in the same manner as the upper, last. The cephalometer is then attached to the impression tray by the insertion (refer to *fig. 1*) of the tray-bar, *B*, into the groove of a special attachment, which has previously, and before its introduction into the mouth, been locked to the impression tray, *A*, by means of the two screws, *W*. The whole is then firmly locked by means of the screw, *E*, to the polar arm, in order to secure immobilization of the head relative to the complete instrument. The polar axis, *F X*, is then brought level to the porion axis, which latter is determined by taking the superior tragion points. This process of orientation is rendered possible by the release of the joint which, while holding the impression tray secure and immoveable both upon the polar arm and in the mouth, permits the rotation in all directions of the cephalometer. The task of leveling for the axis of the porion may be speedily accomplished by levelling the elevation bar (in two directions) against the flat surfaces of a craniometric compass, the points of which have been inserted into the ear-holes. The levelling may be done craniocaudally or bi-laterally. When orientation has been satisfactorily achieved the screw, *E*, is tightened, and the complete head is then ready for measurement by the cephalometer.

Hereafter, any desired point or points may be located in space by placing the surveyor point upon such loci, and determining their position by reading the angles upon the protractors, which, for the sake of uniformity in recording the results, is done by reading the large protractor first and the small protractor second. These readings will produce a sagittal section of the head (Y-Z plane). If projections are desired of the frontal (X-Z) or transverse (X-Y) planes, then the

elevation of each point surveyed must, in addition to the protractor reading, be read on the elevation bar. Linear distances between lateral (right and left) points are also read from the elevation-bar.

III. PLOTTER

The function of the plotter has already been indicated; it is to project the dimensional readings, taken with the cephalometer, upon a plane surface and thus to produce the external form of the recorded

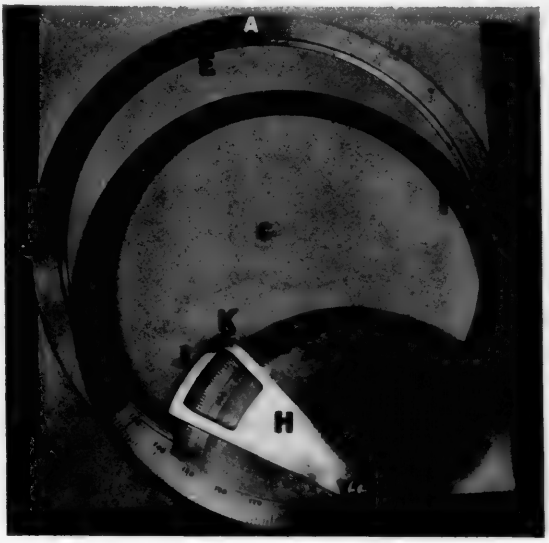

FIG. 5. PLOTTER

A, outer ring. *B*, outer-ring screws. *C*, plotting paper in place on drawing board. *D*, inner ring. *E*, grooved flange. *F*, inner-ring screws. *G*, circular plate. *H*, plotting arm. *I*, potting-arm screw. *J*, vernier scale of plotting arm. *K*, plotting point.

structures. The plotter is an instrument weighing some $7\frac{1}{2}$ pounds, and constructed of nickel, silver and monel. With its board it occupies an area of about 16 square inches. It consists of an outer ring, *A* (*fig. 5*), which is adjustably fixed at the central horizontal diameter by two screws, *B*, to a plane drawing-board, *C*, inferiorily. At 90 degrees to its horizontal axis, there is a Vernier calibration, from the zero of

which all readings are made on the inner ring, *D*, which is calibrated to read to 360 degrees, and which has an inner circumferential diameter of 14 inches. This ring, *D*, fits into the grooved flange, *E*, of *A*, in which it may be freely rotated by means of the screws, *F*. From the superior inner margin of *D*, and extending from the 250th degree to the 150th degree of the latter, is affixed the plate, *G*, running as the inferior 120 degrees of the arc of a circle, i.e., 80 degrees to 0 degree to 320 degrees. The movements of *D* determine the movements of *G*

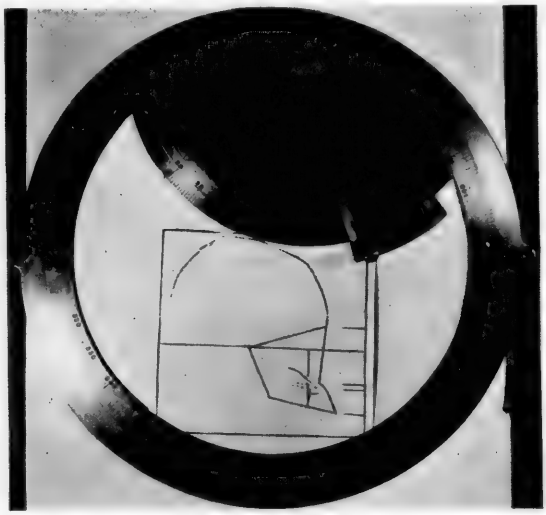

FIG. 6. PLOTTER WITH HEAD MAP IN SITU

The elevations and linear projections have been made with the aid of a ruler. The dotted lines represent the actual plotter-points as reproduced from the cephalometric readings. (See *fig. 13.*)

and *vice versa*. Freely moving upon the circular plate, *G*, is attached the plotting arm, *H*, by means of the screw, *I*. This arm is 7 inches in diameter, and has a Vernier scale at *J* and a plotting-point at *K*. When the inner ring, *D*, is rotated so that its zero registers on the Vernier zero of *A*, and the plotting arm is rotated so that its Vernier zero registers upon the zero of the circular plate, *G*, the plotting point will then rest upon the centre of the central axis of the plotter. If the plotting arm is rotated to its limits to any degree whatever, it will

always bisect the described arcs at the centre of the plotter. Thus, the plotter is able to cover all points within its circumference, and to produce any point whatever that has been taken by means of the cephalometer, within or without the sphere of the head. It is to be observed that the inner ring, *D*, of the plotter corresponds to the large protractor—the circular plate, *G*, to the small protractor—of the cephalometer, whilst the 7-inch plotting arm corresponds to the 7-inch surveyor. It will now be easily understood that when the protractors of the plotting instrument are set to the readings of the cephalometer protractors, the plotting point of the plotter will follow in space the same points as those described by the surveyor point of the cephalometer, and thus give a true dimensional representation for the structures it has been sought to reproduce. *Fig. 6.* shows a plot-map of the head and denture in place within the plotter shortly after completion. It will be seen from this and other maps here produced (*figs. 8, 9, 10*) that, by the superimposition of such transparent maps, much information of the greatest value concerning the growth and movements of the structures examined can be accurately determined and stated in the most exact terms.

Now, in order to obtain a complete map of the head, including the mandible and the relations of the maxillary and mandibular teeth, it is necessary to make two additional separate and distinct maps, one for the maxillary and one for the mandibular teeth. These maps are then accurately related to one another and to the head map. Their projection is made possible by the use of the *dental pantograph* which is now to be described.

IV. DENTAL PANTOGRAPH

The dental pantograph (*fig. 7*), constructed almost entirely of aluminium, consists of a surveying table of light wood, *A*, which represents the surveying plane relative to which all casts must be oriented. This table is about 18 inches square, and allows for all the movements of the surveying-arm; it may be freely rotated upon the socket of the leg upon which it rests. Attached to the surveying table by means of the clamp, *B*, are the following structures: the levelling table, *C*, upon which the dental casts are levelled relative to the surveying table, *A*, by means of three levelling screws, *D*. Upon

the levelling table, *C*, are situated the two swivel plates, *E*, against which the anterior part of the cast conventionally rests, and the clamping plate, *F*, which rests conventionally against the posterior part of

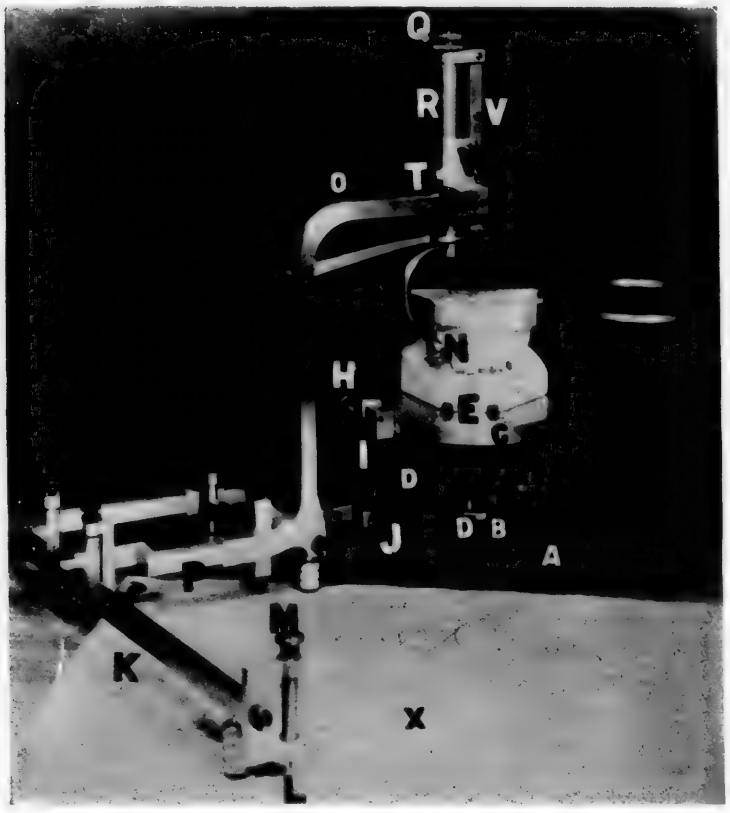

FIG. 7. DENTAL PANTOGRAPH

A, surveying table. *B*, surveying-table clamp, which secures the instrument to the table. *C*, levelling table. *D*, three levelling-table screws. *E*, swivel plates resting against the anterior margin of the cast. *H*, rotary screw. *I*, control lock. *J*, body arm. *K*, surveyor arm. *L*, plotting point. *M*, plotting-point head. *N*, surveyor point. *O*, gallows bar. *P*, horizontal bar. *Q*, surveyor screw. *R*, elevation bar. *S*, gallows socket. *T*, elevation screw. *V*, elevation scale. *W*, vernier scale, only the blank backs of which are visible in this view. *X*, occlusal map in preparation. (The clamping-plate, *F*, and the plate screw, *G*, cannot be seen in this view.)

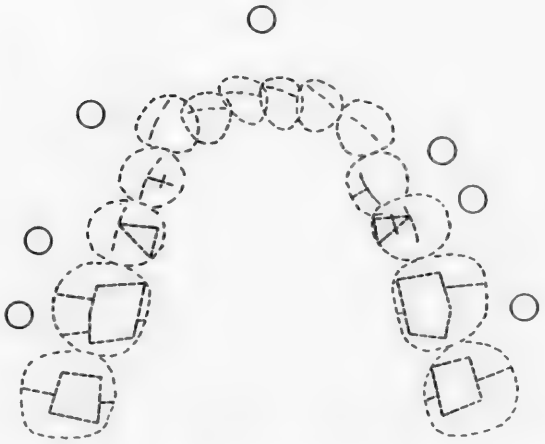

FIG. 8. MANDIBULAR MAP

The circles represent the carbon registration-points of the maxillary map, projected from the maxillary cast, while in proper occlusal relation with the mandibular cast.

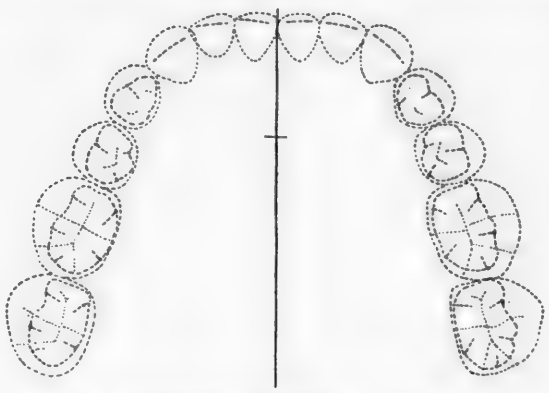

FIG. 9. MANDIBULAR SURVEY OF A NORMAL CASE

Shows the marginal ridges, cusps, triangular ridges, grooves, and incisal edges

the cast, and is tightened against it, so that the immobility of the cast may be secured, by means of the plate screw, *G*. When necessary the

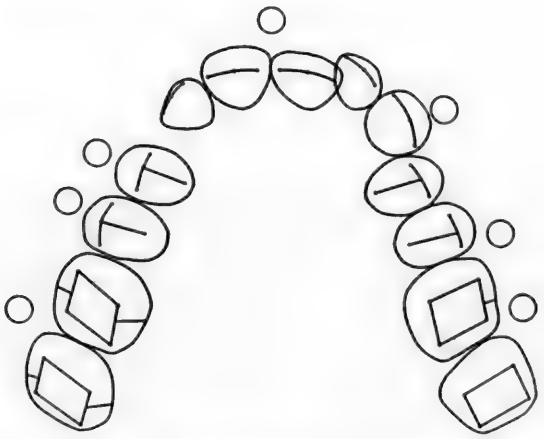

FIG. 10. MAXILLARY MAP REPRESENTING SAME CASE AS FIG. 8

The circles correspond to the carbon registration-points in *fig. 8*. If the map is reversed, and related to the latter map, the circles will register.

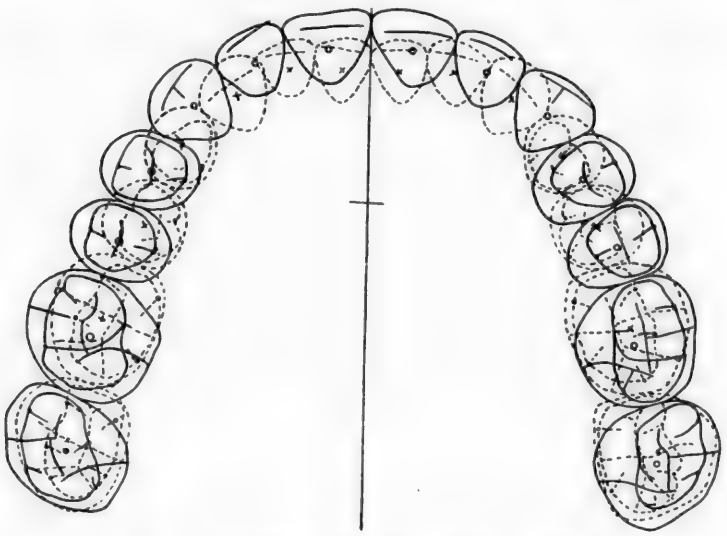

FIG. 11. OCCLUSAL MAP OF A NORMAL CASE

The unbroken lines represent the maxillary teeth; the broken lines, the mandibular teeth, which are shown also in *fig. 9*. The two maps have been related by registration points not shown in this figure.

levelling table may be rotated within a range of some 20 degrees by means of the rotary-screw, *H*, without in any way disturbing the plane previously established. This is rendered possible by the fact that the levelling table is constructed of two distinct plates, an inferior non-rotatable and a superior rotatable plate, the latter moving upon the former with relative rigidity, by the device of the control lock, *I*, which is regulated by the rotary-screw. To the body of the clamp,

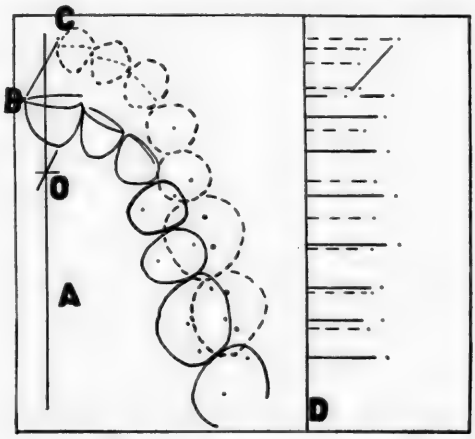

FIG. 12. SIDE-ELEVATION MAP

A, axis of symmetry. *B*, prothion. *C*, infradentale. *D*, plotting base for side elevation of the teeth. *O*, centroid of the denture. The unbroken lines represent the projection of the cusps of the maxillary teeth; the broken lines, the projection of the cusps of the mandibular teeth. The dots to the right of the lines represent the side elevation of the denture.

B, is attached the body arm, *J*, of the surveyor. This arm will move through an arc of 180 degrees, and allows for all possible movements of the surveyor arm, *K*, which will describe a complete circle. These arms may move upon each other relatively and absolutely. At the terminus of the surveyor arm is the plotting point, *L*, which, when pressed down upon its head, *M*, will strike a needle-hole in the plotting paper, and released will return, by the tension of a spring, to its resting position above the paper. The plotting point is controlled by the movements of the freely rotating surveyor-point, *N*, which determines

the movements of the gallows bar, *O*, and horizontal bar, *P*, and thus of the surveyor-arm, *K*. The surveyor-point is moved upwards or downwards and rotated by means of the surveyor-screw, *Q*, to which

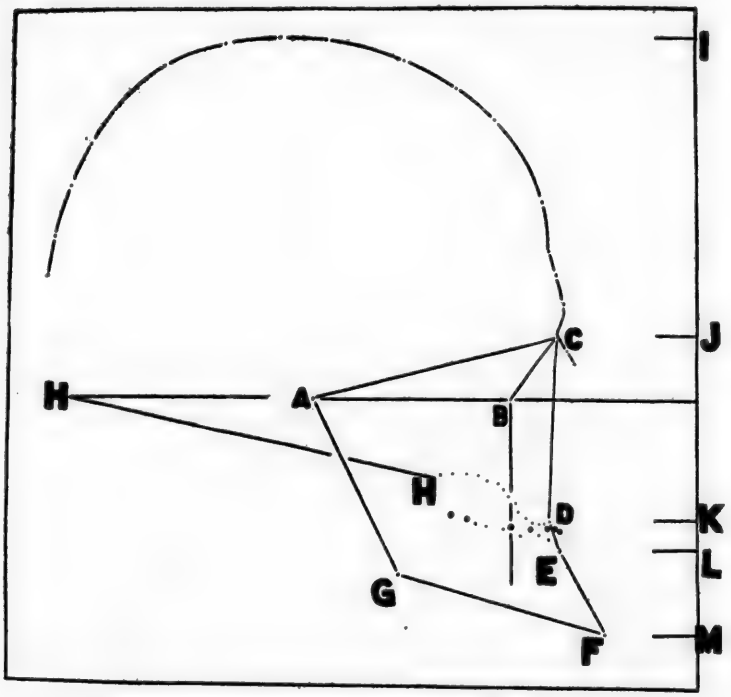

FIG. 13. HEAD MAP

A, porion. *B*, orbital-point (Simon). *C*, nasion. *D*, prosthion. *E*, infradentale. *F*, gnathion. *G*, gonion. *H*, *H*, occlusal-plane parallel. *I*, vertex. *J*, nasion. *K*, prosthion. *L*, infradentale. *M*, gnathion heights. The upper dotted lines represent the hard palate; the circles, the cusps of the mandibular teeth; the lower dotted line, the cusps of the maxillary teeth. (Map prepared by Dr. A. Lees, Department of Orthodontia, New York University.)

it is fixed through the perpendicular body of the surveyor, which passes through the elevation bar, *R*. The elevation bar, though fixed, is relatively rotatable. Since its central axis is the central axis of the rotating but relatively fixed surveyor-point, its movements are deter-

mined by the surveyor-point. The elevation bar passes through the sockets of the gallows bar, within which it freely moves upwards or downwards. The elevation of the surveyor-point may be fixed by means of the elevation-screw, *T*, and the elevation may be read from the elevation scale, *V*, which is fixed to the elevation bar, by means of the Vernier scale, *W*, which is fixed to the gallows socket, *S*. Finally, the pantograph is constructed to enlarge five times. The purpose of this enlargement is to enable the investigator to read the maps more easily, and to deal with them more effectively, than would be possible in a similar time with maps projected to scale, the latter being far too small to be conveniently studied. With the aid of the dental pantograph it is possible to make as complete projections of the dentition and palate as may be desired. The method of making such projections is now to be described.

The dental casts made previously from the plaster cephalometric impressions are clamped upon the levelling table, properly occluded, and levelled by means of the levelling screws as nearly as possible to the *occlusal plane*, which is to be taken as that *horizontal plane relative to which every maxillary tooth not a molar extends below as far as the corresponding mandibular tooth extends above it.* The surveyor point is used to determine the occlusal plane, by rotating it upon the teeth at a locked and constant elevation until, by the levelling process, the plane of occlusion is paralleled to the plane of the surveying table. When this has been accomplished a small piece of carbon paper is applied against the alveolar portion of the upper denture, the surveyor-point is elevated to the plane of the alveolus, and at a constant horizontal is made to describe certain points at arbitrary distances upon it. As these points are marked, they are projected and encircled upon the lower mandibular cast-map. The purpose of this proceeding is to enable the investigator to re-orient the maxillary cast in its particular occlusal plane, after it has been removed from the mandibular cast. The occlusal plane for the upper denture, it is obvious, will now be absolutely determined by the alveolar carbon-points, and its relation to the mandibular cast-map controlled and determined by the encircled projected points (*fig. 8*).

Throughout the process of the projection, the plotting-head (*M*) is used in conjunction with the surveyor-screw (*Q*) to manipulate the

surveyor-point, which is made to follow the marginal ridges, the cusps, the grooves, the triangular ridges, the incisal edges of the teeth (also the transverse ridges of the first molar in the case of the maxillary denture), and the bucco-lingual outline of the form of the teeth at the gingival margin, together with the points, taken from above, at which the teeth are in contact with one another. The bucco-lingual outline is made to run continuously with the projected contact points (*fig. 9*). Thus, while the outline obtained will not be a representation of the actual horizontal transverse form of the tooth at the gingival level, it will however provide what is vastly more important and useful; namely, the mesio-distal contact-diameters of the teeth. The directions of these contact lines or diameters are of the greatest value in reconstructing the most desirable arch form in any particular case. As each point is projected its elevation is read and suitably recorded.

With the completion of the mandibular map, the maxillary map is then separately plotted (*fig. 10*). The occlusal plane is established by the ordinate carbon-points upon the upturned maxillary-cast, and these points are projected and encircled upon the maxillary map now being made. With the completion of this map, the two maps are then accurately related by the following method: First, the maxillary map is reversed (since the cast was so for convenience in projection). Second, the encircled carbon points are superimposed upon the similar points on the mandibular map. Finally, the outlines of the maxillary map are traced upon the outlines of the mandibular map, the resultant map giving a complete representation of the general relations of the teeth in occlusion (*fig. 11*).

The occlusal map completed, the *centroids of the teeth* are found and marked upon the map. The term *centroid* when applied to the teeth is not definitive of the exact geometrical centroid nor of the physical center-mass of the tooth, but is taken to mean merely the most centrally situated point of the tooth as a whole (*fig. 11*). This is determined by the point of intersection of the central mesio-distal and bucco-lingual diameters. The *centroid of the denture*, which may be defined as the geometrical centroid of all the teeth comprising the denture, is then determined upon the map. This is done by placing the map, in any position, upon a drawing board and projecting lines from any selected base through the centroids of the teeth. The

linear distances from the base are added and their sum divided by the number of *dental centroids*. This measure is then projected to its incisal distance from the base and marked, by a short horizontal upon the map (*fig. 11*). Similarly, the process is repeated from any other variant base, the point of intersection obtained being the *centroid of*

TABLE 1

Formula for the axis of symmetry

1	2		3		4	5		6		7		8		EXPLANATION OF FORMULA
1	13	0	15	0	−2.0	7	8	7	4	57	7	−115	4	Col. 1. Number of paired teeth
2	40	0	34	0	6.0	7	7	8	5	65	4	392	4	Col. 2. Vectorial angle of right centroids
3	72	0	81	0	−9.0	7	0	7	3	51	1	−459	9	
4	96	0	102	0	−6.0	8	4	8	8	73	9	−443	4	Col. 3. Vectorial angle of left centroids
5	118	0	121	0	−3.0	11	1	11	3	125	4	−376	2	
6	128	0	131	0	−3.0	15	2	15	6	237	1	−711	3	Col. 4. Column 2 minus column 3 (equals difference in vectorial angle of homologous teeth)
7	9	0	10	0	−1.0	6	3	6	2	39	0	−39	0	
8	27	0	30	0	−3.0	6	7	6	0	40	2	−120	6	
9	50	0	48	0	2.0	7	1	7	1	50	4	100	8	Col. 5. Length of right vectors
10	75	0	75	0	0.0	6	3	6	5	40	9	0	0	Col. 6. Length of left vectors. (A vector is a line from denture centroid at 0 to tooth centroid)
11	95	0	100	0	−5.0	8	2	7	7	63	1	−315	5	
12	117	0	121	0	−4.0	11	0	10	6	116	6	−466	4	
13	131	0	133	0	−2.0	15	0	15	0	225	0	−450	0	Col. 7. Product of column 5 by column 6
										1185	8	−3497	7	
												493	2	Col. 8. Product of column 4 by column 7 (−3004.5 is total of − values and + values of column 8. Total of column 8 is + by total of column 7, and the answer ÷ by 2 = 1.2°, correction for axis)
												−3004	5	$\frac{-3004.5}{1185.8} \div 2 = -1.2°$. If −, assumed axis moves contra-clockwise; if +, assumed axis moves clockwise

the denture. The axis of least asymmetry is next calculated, i.e., the axis with respect to which the denture is most nearly symmetrical. *Table 1* shows the method of applying the formula for the correction of the assumed, and then the establishment of the real, axis. A special protractor is used to measure the vectorial angle and vectorial length of the tooth centroids. When the protractor is placed with its center

upon the denture centroids, and its zero angle upon the assumed axis, the correction formula will then cause this assumed axis to rotate clockwise or counterclockwise, thus determining the axis of least asymmetry. A side elevation of the denture, corresponding to the side of the head that has been plotted, is then made by means of lines drawn at right angles to the axis of the denture through the buccal cusps and the central points on the incisal edges, as well as the prosthion and infradentale. From a suitable base, the elevations previously recorded are plotted upon these lines, the resultant map being a side elevation of the denture, with the prosthion and infradentale properly interrelated (*fig. 12*). This map being 5:1 is then reduced to scale, so that it may conveniently be related to the head map, by the conversion of the surveying apparatus of the dental pantograph, i.e., by using the plotting point to perform the function of the surveying table. A square of cardboard is locked upon the levelling table, over which a similar square of carbon paper is placed, the outlines of the map are followed with the plotting point, and each point is struck upon the cardboard by the surveyor-point. The completed map is slipped under the transparent head-map, so that the cusp points of the teeth register with the same cusp points, as plotted directly from the cephalometric reading of the impression. The infradentale and prosthion and the mandibular points, the gnathion and gonion, are traced upon the head map.

It remains but to register the cusps of the maxillary teeth by placing the side-elevation map over the cephalic map. When correct registration is obtained the maps are immobilized, and the side-elevation points are traced on the cranial map, thus completing the total head map (*fig. 13*).

SUPPLEMENT

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I. New York Academy of Dentistry

NOTES FROM THE MINUTES OF THE PROCEEDINGS IN 1930–31

Malcolm W. Carr, D.D.S., Editor

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Dinner Committee: William C. Keller.
Committee on Dental Education: Thomas Cloney, George M. Babbitt, William C. Keller, *Chairman.*

SCIENTIFIC MEETINGS

Six regular meetings, during the season of 1930–31, were held at the Yale Club, New York City. All of them were preceded by informal dinners.

October. Dr. E. V. McCollum, Johns Hopkins University, addressed the Academy on "The relationship between diet and dental caries."[1] Prof. L. B. Mendel, Yale University, and Dr. Milo Hellman, New York, opened the discussion.

November. Dr. Lowrie J. Porter, New York, and Edward F. Sullivan, Boston, took part in a symposium on "The responsibility of the general practitioner in the care and preservation of children's teeth as related to health and growth." Dr. Porter spoke from the aspect of the orthodontist; Dr. Sullivan, from the periodontist's viewpoint. Dr. W. D. Tracy, New York, formally opened the discussion, speaking from his experience as a general practitioner.

January. A joint medico-dental meeting was addressed by Harlow Brooks, M.D., New York, and Alfred S. Walker, D.D.S., New York, on "Essential factors in coöperation between medicine and dentistry in the prevention of disease."[2] No formal discussion had been prearranged; but, as had been hoped, a free discussion followed by both physicians and dentists. Preceding the papers of the evening, Dr. Milo Hellman read a report on the "White House Conference on Child Health and Protection."[3] Dr. Hellman was appointed by President Hoover as a member of Section I, on "Growth and development."

February. Dr. Frank Casto, Dean of Western Reserve University Dental School, read a paper on "Dental education."[4] Formal discussion was opened by Dr. Alfred Owre, Dean of Columbia University

[1] McCollum, E. V.: *Journal of Dental Research*, 1931, xi, p. 553; August.
[2] Brooks, Harlow, and Walker, Alfred S.: *Ibid.*, p. 811; December.
[3] Hellman, Milo: *Ibid.*, p. 237; April.
[4] Casto, Frank: *Ibid.*, p. 369; June.

Dental School, and Prof. William J. Gies, Columbia University, Editor of the *Journal of Dental Research.*

March. The annual series of progressive table clinics was presented as follows: (a) "Porcelain restoration," by Dr. William A. Spring. (b) "X-ray interpretations: (1) 16-film x-ray series; (2) periodontal, periapical abnormalities," by Dr. John O. McCall. (c) "A simple indirect gold-inlay technique and the flexible joint," by Dr. James K. Burgess. (d) "Something new in indirect inlay impressions," by Dr. John T. Knox.

April (annual meeting). Reports of officers and committees were presented. The following officers were elected for the coming year: *President,* Leuman M. Waugh. *Vice-president,* Joseph D. Eby. *Secretary,* Lowrie J. Porter. *Treasurer,* Alfred L. Kohn. *Editor,* Malcolm W. Carr.

The following seven associate fellows were elevated to active fellowship in the Academy, in recognition of achievements and distinction in the profession: Dr. James C. Allen, Dr. Joseph Burgun, Dr. Fred S. Dunn, Dr. W. J. Hollingshead, Dr. C. Victor Johnson, Dr. Kenneth C. Pruden, Dr. Roy D. Ribble.

A preliminary report of a study by the Research Council, on the use of soaps in the mouth, was presented by Dr. William J. Gies, *Chairman.* Dr. Gies stated that, in this scientific study, the Council is receiving the coöperation of Dr. Victor Ross, now associated with Dr. William H. Park of the New York Health Department, and of the Medical School of New York University.

Mr. Thomas Skeyhill, a well-known war correspondent who has had many interesting experiences in Italy, and has been in close contact with Mussolini, addressed the Academy on the subject: "With Mussolini and the Black Shirts."

COMMENT

During the past year, one meeting was devoted to a broad medico-dental subject, to foster closer coöperation between physicians and dentists.

In February a new class of fellowship was established, known as Allied Fellowship, to include members of professions allied with dentistry.

The Academy was so favorably impressed with the work of the Committee on Community Dental Service, under the auspices of the New York Tuberculosis and Health Association, that the Academy unanimously voted to donate $1,000 in support of the campaign now in progress.

The Research Council is carrying on extensive research in regard to the use of soaps in the mouth. A preliminary statement regarding the literature on soap was given at the April meeting.

A detailed history of the Academy has been prepared by Dr. Bissell B. Palmer. This history, which includes the activities of the Academy during its first ten years (1921–31), will be published in book form. Dr. Palmer presented a brief résumé of this history at the April meeting, in recognition of the tenth anniversary of the founding of the Academy.

IN MEMORIAM

James Peter Ruyl

The following memorial and resolutions were adopted at the January meeting:

"The news of the death of James Peter Ruyl, on December twenty-ninth, brought sadness to the heart of every Fellow of the New York Academy of Dentistry, and to a host of friends and admirers throughout the world of dentistry in which he had for so many years been an active and useful figure. Dr. Ruyl was born in Brooklyn, New York, on March 17, 1873, and spent the early years of his life in Brooklyn. He took his dental degree at the New York College of Dentistry in 1894, and for twenty years conducted a successful practice in Brooklyn, after which he transferred his office to Manhattan. On December 16, 1896, Dr. Ruyl married Miss Charlotte Stillman, to whom four children were born. He is survived by four children: James P. Ruyl, Jr., Dr. Horace Ruyl, Rudolph Ruyl, and Elsa Ruyl.

"Because of his sterling character and fine personal qualities, and his unusual contributions to the science and art of dentistry, coupled with his unselfish devotion to his profession, Dr. Ruyl had gained an enviable reputation. Sensitive and responsive to beauty in nature, he expressed himself in his special field of work and excelled in developing esthetic effects that were unsurpassed. He also found pleasure in giving freely to others from his fund of genius and experience, thus inspiring many to better effort. His

contributions to dental literature were numerous. In the field of dental prosthesis he was an admired authority, who will be missed not only by his colleagues, but by a large list of devoted and appreciative patients. As a friend, as a genial and hospitable host, and as an out-of-doors companion, Dr. Ruyl was a man of rare charm, and his cheerful and sunny personality was reflected upon all who were associated with him. The following resolutions are herewith submitted:

"*Whereas*, our friend and fellow Academician has been lost to us through death, be it, therefore,

"*Resolved*, that this Academy hereby expresses its deep sense of grief and extends to his bereaved family the keen sympathy of its members; and, be it further

"*Resolved*, that this memorial minute and resolution be inscribed upon the records of this Academy, and that a copy be sent to the bereaved family."

Arthur Haas

The following memorial and resolutions were adopted at the February meeting:

"After a very interesting career, Dr. Arthur Haas, passed away January 12, 1931, in the fifty-first year of his age. Dr. Haas was born in New York City, in April 1880, and educated at Sacks School and the Peekskill Military Academy. He received his dental education at the University of Pennsylvania and upon graduation, in 1902, established in New York City.

"He acquired a very large practice, and counted among his patients some of the most prominent and influential people in this city. Dr. Haas was a skillful dentist and a very rapid operator, and was able to accomplish as much in his twenty-eight years of service as many others have done in a much longer life of activity. He served humanity devotedly; and for five years was connected with St. Bartholemew's Hospital. Dr. Haas had social gifts, and was a member of the Quaker Ridge Golf Club. He was a polished gentleman, a loyal friend, and a devoted husband and brother. In 1907 he married Miss Nina Ehrenreich, who survives him.

"Dr. Haas was a member of the First District Dental Society, the New York State Dental Society, the American Dental Association, and an Associate Fellow of the Academy of Dentistry. The Academy has lost in his death a friend and valuable member, and one who upheld the highest ideals of our profession. The following resolutions are submitted:

"*Whereas*, it has pleased Almighty God to remove from our midst Dr. Arthur Haas, be it therefore

"*Resolved*, that we, members of the New York Academy of Dentistry deeply sense the loss of a valued member, whose services to humanity in the skillful practice of dentistry made him prominent in our beloved profession; be it further

"*Resolved*, that we tender our heartfelt sympathy to the bereaved family, and that a copy of these resolutions be spread upon the minutes of the Academy."

II. International Association for Dental Research

Memoranda on the Proceedings in 1930–31[5]

William J. Gies, F.A.C.D., Secretary

Ninth General Meeting

The ninth general meeting of the International Association for Dental Research, held in Memphis, Tennessee, at the Hotel Peabody, on March 21 and 22, 1931, was coördinated by agreement with the eighth annual meeting of the American Association of Dental Schools, which was convened in the same rooms on March 23–25, inclusive. The members of each body were welcome at, and participated in, all sessions of both associations. The chairmen at the meetings of the Research Association were the President, U. G. Rickert, University of Michigan; the President-elect, A. E. Webster, University of Toronto; and the Vice-president, R. W. Bunting, University of Michigan. At each of the three daily sessions there was a large attendance and the interest was sustained, 87 members and guests having been present at the annual dinner on the evening of March 22. At this session, the last of the six, the President's annual address was delivered (this volume, pp. 438–449), two papers were presented, and the executive work

[5] A brief outline of the organization and early development of the International Association for Dental Research, including the Constitution, was published on pages 197–208 of Volume VIII (1928) of the *Journal of Dental Research*. This was followed, in the same issue, by a summary of the proceedings of the general meetings from 1920 to 1927, inclusive, and a register of membership as of March 15, 1928 (pp. 209–233). Records of the subsequent proceedings were published in the *Journal of Dental Research* as follows: ***Sixth*** general meeting (1928, viii)—abstracts, page 395; executive proceedings, page 696. ***Seventh*** general meeting (1929, ix)—abstracts, p. 269; executive proceedings, p. 756. ***Eighth*** general meeting (1930, x)—abstracts, p. 367; executive proceedings, p. 782. ***Ninth*** general meeting (1931, xi)—abstracts, p. 437.

was concluded. The coöperation of the Vienna Section, which presented 20 papers in a total of 80 on the program, was a feature of the meeting. Abstracts of all the papers, covering a very wide field of interest and activity, were published on pages 450–540 of this volume. Reprints of the President's address and of the abstracts were distributed to all the members, to the medical and dental schools in North America, and to many persons specially interested in the promotion of dental research. The colleagues listed on pages 540–42 of this volume were elected to membership. A register of the officers and members, as of December 1, 1931, is given on pages 910–12, where it will be seen that there are now 240 members and 17 sections.

This meeting demonstrated again the great value of coördinated meetings of the International Association for Dental Research and the American Association of Dental Schools. March 21 and 22 were devoted by the Research Association wholly to research sessions, at which all members of the dental faculties were welcome, not only as visitors but also as participants in the discussions. March 23 to 25 were given by the School Association entirely to problems of teaching and administration, in the discussion of which all members of the Research Association were free to present such findings and conclusions of research as were related to the subjects before the house. The result was, in effect, a five-day meeting devoted to research, teaching, and administration. To all concerned in the advancement of dental science and of dental education, these conditions afforded exceptional opportunities to participate actively and effectively to that end.

SECTIONS

The sections in existence at the date of this general meeting were those in Ann Arbor, Boston, Chicago, Cleveland, Halifax, Minnesota, New Haven, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis, Toronto, Vienna and Winnipeg, constituting the Austrian, Canadian, and United States Divisions. Since the Memphis meeting, sections have been organized in London, England, and Washington, D.C. During 1930–31 meetings of the sections were held on this schedule:

Ann Arbor: June 11. *Boston:* January 26, May 14. *Chicago:* October 16, January 8, February 1, April 30. *Cleveland:* March 9.

Halifax: November 28, February 28, April 24, *London:* June 9. *Minnesota:* October 27, November 24, January 26, March 30, April 27. *New Haven:* February 12. *New York:* December 10, May 21. *Philadelphia:* October 13, June 24. *Pittsburgh:* November 3, December 1, January 5, February 2, March 2, May 18. *St. Louis:* December 23, January 13, April 14. *Toronto:* February 5.

Proceedings of sectional meetings have been published on pages 51, 53, 235, and 633 of this volume.

NEXT (TENTH) GENERAL MEETING

The next general meeting will be held in Columbus, Ohio, March 19 and 20, 1932, preceding and in coördination there with the ninth annual meeting of the American Association of Dental Schools, March 21–23, inclusive.

REGISTER OF MEMBERS AND OFFICERS: DECEMBER 1, 1931

Members

1. *Ann Arbor Section.*—R. K. Brown, R. W. Bunting, Faith P. Hadley, Philip Jay, C. J. Lyons, **U. G. Rickert*, E. O. Scott, F. B. Vedder, M. L. Ward—9

2. *Boston Section.*—L. W. Baker, **F. R. Blumenthal*, W. G. Bridge, F. P. Chillingworth, H. DeW. Cross, F. H. Daley, C. E. Hatch, E. A. Hooten, P. R. Howe, V. H. Kazanjian, P. A. Leavitt, F. P. McCarthy, L. M. S. Miner, A. L. Morse, F. W. Morse, William Rice, A. P. Rogers, Benjamin Spector, K. H. Thoma, Benjamin Tishler, Harry Trimble, G. H. Wright—22

3. *Chicago Section.*—H. C. Benedict, Olaf Bergeim, A. D. Black, J. R. Blayney, E. P. Boulger, E. D. Coolidge, D. J. Davis, R. H. Fouser, T. L. Gilmer, E. H. Hatton, Rudolf Kronfeld, F. B. Moorehead, Emil Mueller, Anna C. Nichols, F. B. Noyes, H. J. Noyes, V. T. Nylander, W. F. Peterson, H. A. Potts, Isaac Schour, B. O. Sippy, **W. G. Skillen*, S. D. Tylman, W. H. Welker—24

4. *Cleveland Section.*—B. H. Broadbent, **S. W. Chase*, T. J. Hill, V. C. Myers, W. A. V. Price, F. C. Waite—6

5. *Halifax Section.*—J. S. Bagnall, R. J. Bean, W. G. Dawson, A. W. Faulkner, A. B. Haverstack, W. C. Oxner, S. G. Ritchie, R. P. Smith, G. K. Thomson, E. G. Young—10. (H. M. Eaton, an associate member, is Secretary of the Section.)

* Secretary of the Section.

6. *London Section.*—Arthur Bulleid, J. F. Colyer, F. N. Doubleday, E. W. Fish, **Evelyn Sprawson*, J. G. Turner—6

7. *Minnesota Section.*—E. S. Best, P. J. Brekhus, J. T. Cohen, I. A. Epstein, B. S. Gardner, C. J. Grove, H. A. Maves, J. F. McClendon, F. S. Meyer, G. S. Monson, W. R. Schram, W. D. Vehe, H. F. Wahlquist, **C. W. Waldron*, H. G. Worman—15

8. *New Haven Section.*—**B. G. Anderson*, C. G. Burn, A. M. Crosby, W. G. Downs, Jr. (Evansville, Ind.), R. G. Hussey, H. A. Miller, J. P. Pigott, G. H. Smith, J. J. Wolfe—9

9. *New York Section.*—Edmund Applebaum, Adolph Berger, Theodor Blum, C. F. Bödecker, L. R. Cahn, M. W. Carr, H. E. S. Chayes, G. W. Clapp, H. S. Dunning, W. B. Dunning, J. D. Eby, S. W. A. Franken, W. J. Gies, H. W. Gillett, W. K. Gregory, Milo Hellman, I. Hirschfeld, R. G. Hutchinson, Jr., T. P. Hyatt, A. L. Johnson, Maxwell Karshan, F. C. Kemple, Frances Krasnow, H. J. Leonard, J. O. McCall, F. S. McKay, A. H. Merritt, E. G. Miller, Jr., **B. B. Palmer*, Theodor Rosebury, M. I. Schamberg, Joseph Schroff, P. R. Stillman, L. M. Waugh, B. W. Weinberger, J. L. Williams, J. L. Zemsky, D. E. Ziskin—38

10. *Philadelphia Section.*—J. L. T. Appleton, Jr., Mrs. C. K. Bryant, **T. J. Cook*, J. A. Detlefsen, R. H. Ivy, J. V. Mershon, S. E. Pond, Hermann Prinz, C. R. Turner—9

11. *Pittsburgh Section.*—T. W. Brand, K. W. Dewey, W. L. Fickes, F. C. Friesell, H. E. Friesell, E. G. Meisel, W. P. Swanson, **L. E. Van Kirk*, W. H. Wright—9

12. *St. Louis Section.*—W. A. Chamberlain, E. H. Keys, E. B. Owen, H. R. Raper (Albuquerque, N. M.), **C. O. Simpson*, R. C. Wheeler, J. D. White, G. B. Winter—8

13. *San Francisco Section.*—G. L. Bean, B. E. Lischer, J. A. Marshall, E. H. Mauk, G. S. Millberry, F. H. Orton, **J. S. Shell*, F. V. Simonton—8

14. *Toronto Section.*—J. F. Adams, G. R. Anderson, H. K. Box, **A. J. Broughton*, Thomas Cowling, A. W. Ellis, C. J. Fraser, G. W. Grieve, Andrew Hunter (Glasgow, Scotland), F. C. Husband, A. J. McDonagh, E. W. Paul, R. J. Reade, H. S. Thomson, W. C. Trotter, A. E. Webster—16

15. *Vienna Section.*—Arved Berg, Karl Breitner, Fritz Driak, Bernhard Gottlieb, Richard Grohs, Otto Hofer, Ernst Kellner, **Emerich Kotanyi*, Moriz Leist, Balint Orban, Hans Pichler, Otto Preisecker, Franz Schönbauer, A. M. Schwarz, Harry Sicher, Karl Spring, Georg Stein, Richard Trauner, Josef Weinmann, Herman Wolf—20

* Secretary of the Section.

16. *Washington Section.*—A. B. Crane, R. A. Keilty, Henry Klein (Baltimore), E. V. McCollum (Baltimore), **G. C. Paffenbarger*, F. E. Rodriguez (Camp Holsbird, Md.), Wilmer Souder, W. T. Sweeney, N. O. Taylor—9.

17. *Winnipeg Section.*—**E. R. Bier*, F. T. Cadham, M. H. Garvin, K. M. Johnson, H. J. Merkeley, W. J. Riley—6

18. *Not now members of a section.—Detroit.*—W. E. Cummer. *Germany.*—Wilhelm Dieck (Berlin), Guido Fischer (Hamburg), Otto Loos (Frankfurt), Friedrich Proell (Greifswald), Rudolf Weber (Cologne). *Honolulu.*—Martha R. Jones. *Indianapolis.*—S. L. Davis. *Iowa City.*—A. W. Bryan, C. L. Drain, R. H. Volland. *Louisville.*—T. B. Beust. *Omaha.*—R. Wood Leigh. *Philadelphia.*—W. R. Pentz. *West China* (Chengtu).—R. Gordon Agnew. *Address unknown.*—Anne G. E. Mackenzie (formerly of the Winnipeg Section)—16

Total number of members—240; average membership of seventeen sections, 13

Officers: 1931–32

President—A. E. Webster, University of Toronto. *President-elect*—R. W. Bunting, University of Michigan. *Vice-president*—E. H. Hatton, Northwestern University. *Treasurer*—William Rice, Tufts College. *Secretary*—William J. Gies, Columbia University.

III. Notes on the William J. Gies Fellowship in Biological Chemistry at Columbia University[6]

Edgar G. Miller, Jr., Ph.D., Chairman of the Fellowship Committee

Temporary Change of Plan

In earlier reports relating to the Fellowship, it was indicated that Dr. Gies, who nominates the Fellows, would select candidates desirous of conducting *dental* research. On February 1, 1930, a three-year plan of research was inaugurated in the Dental School, with the aid of a grant from the Commonwealth Fund. To avoid possible intrusions into that work, it has seemed desirable temporarily to discontinue the appointment of Fellows to conduct *dental* research.

Work of the Third Fellow

Dr. Victor Ross, appointed third Fellow on February 1, 1930, to succeed Dr. Theodor Rosebury, completed his term on June 30, 1931.

* Secretary of the Section.

[6] Previous reports relating to the Gies Fellowship were published in the *Journal of Dental Research*: (1) 1927, vii, p. 530; (2) 1928, viii, p. 679; (3) 1929, ix, p. 741; (4) 1930, x, p. 771.

During his incumbency, Dr. Ross finished an inquiry into the fate of orally administered specific polysaccharide of pneumococcus, and also began, under the auspices of the Research Council of the New York Academy of Dentistry, a review of the literature on the physiological action of soaps. Both studies will soon be published.

FOURTH FELLOW

The present incumbent of the Fellowship, Dr. Robert M. Herbst, is conducting research on the oxidation of amino acids.

REGISTER OF FELLOWS

I. 1928 (Feb. 1–June 30): *James M. Inouye*[7]
B. S. (Emory, 1915), M. A. (Columbia, 1917), Ph.D. (Columbia, 1925)

II. 1928–1930 (July 1–Jan. 31): *Theodor Rosebury*
D.D.S. (Pennsylvania, 1928)

III. 1930–31 (Feb. 1–June 30): *Victor Ross*
B.S. (College of the City of New York, 1916), M.A. (Columbia, 1918), Ph.D. (Columbia, 1923)

IV. 1931–1932 (July 1–June 30): *Robert M. Herbst*
B.Chem. (Cornell, 1926), Ph.D. (Yale, 1930)

FINANCIAL SUMMARY

Principal of the William J. Gies Fellowship Fund, held by Columbia University on June 30, 1930, as recorded in the last annual statement[8]	$31,476.31
Additions to the *principal* of the Fund in 1930–31:	
One half of the income in 1930–31 (by the terms of the gift)[9]	786.91
Unexpended portion of the remaining half of the year's income	11.91
Total amount of the principal on June 30, 1931	$32,275.13

[7] Died September 17, 1931.

[8] Miller: *Journal of Dental Research*, 1930, x, p. 773.

[9] Goodridge, Howe, Dunning, and Waugh: *Journal of Dental Research*, 1927, vii, p. 530. From 1928–1937, inclusive, 50 per cent of the annual income will be added to the principal amount of the Fund; from 1938–1947, inclusive, 30 per cent; from 1948–1957, inclusive, 10 per cent. Beginning in 1958 (January 1), the whole of the annual income will be available for current use.

An anonymous donor contributed $125 to raise the stipend of the Fellow for 1930–31 from $786.91 to $900, the balance ($11.91) to be added to the principal amount of the fund. In addition, the Fellow in 1930–31 received an honorarium of $500 from the New York Academy of Dentistry in support of the study of soaps mentioned above, which was completed by the Fellow after his term expired.

IV. Quotations on the Status of Dentistry

Assembled from the quotations published on pages 2 and 3 of the covers on the six numbers of this volume

This Journal uses the term "dentistry" to signify the science and art of oral health-service in all its local and systemic relationships. The meanings of words, which are not necessarily restricted to *etymological* significance, acquire expanded or new import in accordance with convenience and usage. Thus the term "medicine," which originally meant to remedy or cure, now also means *to make remedial or curative treatment unnecessary.* "Stomatology" is a synonym for "dentistry." We prefer the older term because its use respects both the history of dentistry and the efforts of those who have brought dentistry to its present status.—*Journal of Dental Research*, 1929, ix, p. iii.

If dentistry were merely dental mechanics, a two-year course in dental technology, based on graduation from a high school and conducted along lines similar to those for the education of optometrists, would probably afford sufficient training for dental practice, and oral health-service could be reserved for a new specialty to include oral surgery, which might be named stomatology and made analogous to ophthalmology and other specialties of medicine. But with dentistry developed into the *full service equivalence* of an oral specialty of medicine, the creation of a medical specialty of stomatology would be redundant—and there would be no occasion to substitute "stomatology" for the name established by custom.—*Carnegie Foundation's Bulletin on Dental Education*, 1926, p. 135.

The assumption that dentistry would be something more or better than it is, if all or a part of it were called "stomatology," exemplifies a readiness to attach more importance to labels than to contents, or more significance to make-believe than to reality. The term "medicine" originally meant to remedy or cure. ["*Medicina* (ars)"—healing art; "*medicina* (res)"—a remedy; "*medicus*"—of healing; also a physician.] Today "medicine," by including measures to *prevent* sickness and by throwing *etymology* overboard, means not only to remedy or cure, but also *quite the contrary*—to make remedial or curative treatment unnecessary. As medical knowledge has advanced and medical procedures have been changed in consonance, including the development of prevention and of surgery, new meanings have been imparted to the term "medicine." But instead of replacing "medicine" by a succession of words intended to indicate *etymologically* the broader or deeper modern meanings, the import of the original term has been conveniently enlarged as the scope of medical practice has expanded. Thus, the term "medicine" has come to mean more and more as *physicians*, without restricting themselves to its *etymology*, have included *more and more in its significance*. Along the same line of reasoning one sees clearly that, although *etymologically* the term "dentistry" refers only to the teeth, nevertheless logically it also comprehends the contiguous parts and their systemic relationships. Certainly by *usage* in conformity with this logic, and also with the criteria of common sense, the term "dentistry" has *acquired* the broader meaning suggested by the more detailed and lengthy term "oral health-service." By logic, usage, and convenience, the term "dentistry" has thus become the *practical* equivalent of "stomatology," which *etymologically* means the sum of scientific knowledge concerning the mouth, but *etymologically does not include the rest of the body* (although "stomatology" is now *used* by some to include systemic relationships with the mouth). This being true, we are unable to agree that "dentistry" and "dentists," which are terms that have long represented the earnest and aspiring endeavors of generations of faithful practitioners of oral health-service, should be formally replaced for *etymological* reasons by "stomatology" and "stomatologists."—*Committee on Education, Research, and Relations; American College of Dentists*, March, 1929.

The New York Academy of Dentistry . . . without any diminution of its abiding purpose to promote intimate association and coöperation between dentists and the practitioners of all other kinds of health service, believes that, in the interest of the patient, dentistry should be *continued* as a separately organized profession, based on systems of ethics, education, jurisprudence, and journalism that will fully meet all public needs at each stage of its evolution.—*N. Y. Academy of Dentistry, April, 1929.*

The Dental Society of the State of New York . . . . expresses the earnest conviction . . . . that the most effectual development of oral health-service will be insured by the *continuance* of dentistry as a separately organized profession . . . [and] also records its unabated desire and intention to promote personal and professional accord, coöperation, and mutual helpfulness between dentists and the practitioners of medicine and all other kinds of health service.—*Dental Society of the State of New York, May, 1929.*

Whereas the American College of Dentists is cognizant of the opinion and sentiment, expressed in certain sections of this country, that dental practice could more effectually fulfill its functions by becoming an integral part of medical practice; and

Whereas it is being represented that this opinion is held or endorsed by a considerable portion of the dental profession; therefore, it is hereby

Resolved that the American College of Dentists records its conviction that the above mentioned opinion does not represent the views of more than an extremely small minority of the members of the dental profession; also

Resolved that dentistry, which has evolved during the past ninety years as a natural and distinct division of health service, can best meet the needs of mankind by the further development of its ideals and service through separate and special educational activities, professional practice, and statutory regulation; also

Resolved that the existing personal and professional coöperation and mutual helpfulness between dentists and physicians, and between

dentists and practitioners of other kinds of health service, should be continued and strengthened, and that, in harmony with the objects and history of the American College of Dentists, suitable means should be taken by the College at all times to further this accord.—*American College of Dentists, March, 1929.*

Whereas, dentistry, as a separately organized profession, is approaching its one hundredth anniversary; and

Whereas, the profession has achieved remarkable progress in that period, despite numerous handicaps and important opposition; and

Whereas, it is entirely practicable for dentistry to further progress under its own auspices, to the end that it shall become the full health-service equivalent of a specialty of medical practice; and

Whereas, there are current doubts in some quarters outside of the dental profession in relation to the preferences of the profession regarding its own evolution and future; . . . . therefore

Be it resolved, that the American Association of Dental Schools records its opinion that the interests of the public health, and of the medical and dental professions, would best be served by a continuation of the separate organization of the dental profession; and

Be it further resolved, that this Association records its conviction that the recently advocated concept of an ideal dental service, to be practised by a physician-dentist assisted by a group of technicians, is neither practicable nor logical, nor conducive to the best interests of the public; . . . . —*American Association of Dental Schools, March, 1931.*

The stomatologist's concept of dental education and practice finds expression in the activities of a very limited group in this country who, as far as I can see, are making no headway in dissecting a part of the practice of dentistry from its whole and grafting it on medicine; nor do I believe that medicine would welcome such implantation. I have no apprehension over the stomatologist's point of view. In the four countries in Europe, Austria, Czecho-Slovakia, Belgium and Italy, where one must possess a medical degree to practise dentistry, the poorest type of technical dental service is to be found. In Switzerland,

Sweden, Norway and parts of Germany, where dentistry is taught in conjunction with medical studies, yet independent of medical supervision, as we teach it in this country, the best type of service is found. Based on my own study of the problem in Europe [1926–27], I would both seek and recommend the services of dentists trained in the latter countries during the past decade and would avoid service in the former, unless I knew the dentist and his work personally.—*Guy S. Millberry*, D.D.S., *Dean, Dental School, University of California; Pacific Dental Gazette, 1931, xxxix, p. 415; June.*

It is almost twenty years since I made my first appearance on the platform at a meeting of dentists; to be exact, the date was January 31, 1913. At that time I challenged the members of the dental profession, and told them that the next great step in medical progress in the line of preventive medicine must come from them. I am happy to be able to say that they have done their part.—*Charles H. Mayo*, M.D., F.A.C.S., D.P.H., LL.D., D.Sc., etc.: *Dental Roster, 1931, iv, p. 24; Aug. 29.*

In a time of stress, between three and four thousand dentists journey to Paris [Eighth International Dental Congress], many of them from considerable distances and at great expense, and spend one week examining and discussing the many ramifications of their chosen work. . . . . Three thousand dentists from all over the world do *not* journey great distances and give up one week to discuss something in regard to which they have lost all hope, and in regard to which they have no confidence and no belief in a future, nor is it possible for any activity in a moribund condition to be responsible for such a programme as was presented in Paris. . . . . The recent Congress proves conclusively that power to progress has not ceased to exist, and that there need be little fear for the future of dentistry.—*Editorial: Dental Magazine and Oral Topics, 1931, xlviii, p. 955; September.*

Nothing is to be gained by converting a first-class dentist into a mediocre medical practitioner. . . . . I do not believe it is practical to unify the dental and medical curricula so as to provide for the same

training of dentists and physicians during any considerable part of their academic careers. . . . . Dentistry is a very specialized field of medicine which has already been elevated to a standard of professional excellence entirely comparable with that of other medical specialties. *The average American dentist is at least as well qualified to render adequate service in his field of work as is the average otolaryngologist, ophthalmologist or surgeon* [italic not in the original]. Dental education in America has been notably effective, and that is to the credit of the profession. . . . . Changes should not be made at the expense of that which has been found good through long practical experience . . . . I am . . . . entirely unconvinced that any plan for the unification of the dental and medical curricula would result in the training of better qualified dentists. Dentistry is a profession which has become firmly established in its own right, and one which comprises a number of specialties. *It would lose much by becoming a minor subdivision of medicine* [italic not in the original]. It had best retain its independence.—*W. McKim Marriott*, M.D., *Dean of the School of Medicine, Washington University, St. Louis, Mo.; Journal of Dental Research*, 1931, xi, p. 807; October.

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Quotations on the Status of Dentistry (continued)

It is almost twenty years since I made my first appearance on the platform at a meeting of dentists; to be exact, the date was January 31, 1913. At that time I challenged the members of the dental profession, and told them that the next great step in medical progress in the line of preventive medicine must come from them. I am happy to be able to say that they have done their part.—*Charles H. Mayo, M.D., F.A.C.S., D.P.H., LL.D., D.Sc., etc.: Dental Roster, 1931, iv, p. 24; Aug. 29.*

In a time of stress, between three and four thousand dentists journey to Paris [Eighth International Dental Congress], many of them from considerable distances and at great expense, and spend one week examining and discussing the many ramifications of their chosen work. . . . . Three thousand dentists from all over the world do *not* journey great distances and give up one week to discuss something in regard to which they have lost all hope, and in regard to which they have no confidence and no belief in a future, nor is it possible for any activity in a moribund condition to be responsible for such a programme as was presented in Paris. . . . . The recent Congress proves conclusively that power to progress has not ceased to exist, and that there need be little fear for the future of dentistry.—*Editorial: Dental Magazine and Oral Topics, 1931, xlviii, p. 955; September.*

Nothing is to be gained by converting a first-class dentist into a mediocre medical practitioner. . . . . I do not believe it is practical to unify the dental and medical curricula so as to provide for the same training of dentists and physicians during any considerable part of their academic careers. . . . . Dentistry is a very specialized field of medicine which has already been elevated to a standard of professional excellence entirely comparable with that of other medical specialties. *The average American dentist is at least as well qualified to render adequate service in his field of work as is the average otolaryngologist, ophthalmologist, or surgeon* [italic not in the original]. Dental education in America has been notably effective, and that is to the credit of the profession. . . . . Changes should not be made at the expense of that which has been found good through long practical experience. . . . . I am . . . . entirely unconvinced that any plan for the unification of the dental and medical curricula would result in the training of better qualified dentists. Dentistry is a profession which has become firmly established in its own right, and one which comprises a number of specialties. *It would lose much by becoming a minor subdivision of medicine* [italic not in the original]. It had best retain its independence.—*W. McKim Marriott, M.D., Dean, Medical School, Washington University, St. Louis, Mo.; Journal of Dental Research,* 1931, xi, p. 807; October.

Important Books Received

Abnormal conditions of the teeth of animals in their relationship to similar conditions in man. By Sir Frank Colyer, K.B.E., F.R.C.S., L.D.S. 1931: pp. 167; 7½ x 4¾ in.; 217 illustrations; five shillings net. Dental Board of the United Kingdom, 44 Hallam St., W.1, London, England.

Anuario Dental. By Salvador de Casas and Joaquin de la Hoz (and numerous collaborators). 1929–30: pp. 534; 6¾ x 4½ in.; 127 illustrations; 12 pesetas. Calle de Galileo, 5, pral, Madrid, Spain.

Practical physiological (biological) chemistry. By Philip B. Hawk, M.S., Ph.D., President of the Food Research Laboratories, Inc., New York City, and Olaf Bergeim, M.S., Ph.D., Associate Professor of Physiological Chemistry, University of Illinois, College of Medicine, Chicago, Ill. 1931: pp. 929; 7½ x 4½ in.; 287 illustrations; $6.50. P. Blakiston's Son and Co., Inc., Philadelphia, Pa.

Annual report (reprinted papers) of the investigations carried out under the supervision of the Therapeutic Research Committee, Council on Pharmacy and Chemistry, American Medical Association: vol. xix, 1930. 1931: pp. 447; 7½ x 4½ in.; 73 illustrations. American Medical Association, Chicago, Ill.

New book of special interest to dentists

The book by Maurice William, D.D.S., entitled *The Social Interpretation of History: a Refutation of the Marxian Economic Interpretation of History* (1921), converted Dr. Sun Yat-Sen, the venerated leader of the Chinese revolution, from a pro-Marxian to an anti-Marxian philosophy. Dr. William's book has been discussed in this *Journal* as "*a living American dentist's epochal intellectual contribution to world history*" (1931, xi, p. 497). Dr. William has completed a related volume entitled "*Sun Yat-Sen Versus Communism: New Evidence Establishing China's Right to the Support of Democratic Nations.*" It will contain a Foreword by Dr. Ray Lyman Wilbur, Secretary of the Interior. The new book by Dr. William, published by the Williams & Wilkins Co., Mt. Royal and Guilford Avenues, Baltimore, Md., will be ready for distribution early in January. Price $5.00. Subscriptions may be sent to the publisher.

INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH

Meetings in 1930–31

SECTIONS. *Ann Arbor:* June 11. *Boston:* January 26, May 14. *Chicago:* October 16, January 8, February 1, April 30. *Cleveland:* March 9. *Halifax:* November 28, February 28, April 24. *London:* June 9. *Minnesota:* October 27, November 24, January 26, March 30, April 27. *New Haven:* February 12. *New York:* December 10, May 21. *Philadelphia:* October 13, June 24. *Pittsburgh:* November 3, December 1, January 5, February 2, March 2, May 18. *St. Louis:* December 23, January 13, April 14. *Toronto:* February 5.

ASSOCIATION: Ninth general meeting, Memphis, March 21–22, 1931.

Meetings in 1931–32

SECTIONS. *Ann Arbor:* November 2. *Boston:* December 21, February 11, May 12. *Chicago:* October 9, January 17, March 4, May 6. *Cleveland:* December 14. *Halifax:* October 2, November 27, January 29, March 11. *Minnesota:* November 30, January 25, February 29, March 28, April 25. *New Haven:* December 7. *New York:* December 10. *Philadelphia:* November 24. *Pittsburgh:* October 5, November 2, December 7, January 4, February 1, March 7, April 4, May 2. *St. Louis:* October 13, January 12, April 12. *Toronto:* November 12. *Washington:* October 13.

ASSOCIATION: Tenth general meeting, Columbus, Ohio, March 19 and 20, 1932.

All persons interested in dental research are invited to attend the scientific meetings of the Sections and of the Association.

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